

Marine Engineering

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Fig. 1.—United States Battleship *Tennessee*, America's Latest Superdreadnought

Propelling Machinery of the U. S. S. Tennessee

Latest American Battleship Driven by Electricity Generated in Westinghouse Turbine Generators Delivering 40,000 Horsepower

SINCE the U. S. S. *Tennessee* is the first battleship to be designed specifically for steam-electric propulsion (the *New Mexico* having been originally intended for turbine drive), her propelling equipment is of special interest. The general arrangement of her machinery is as follows:

Each turbine generator unit with its exciters is located in a separate watertight compartment, and its condensers, pumps, air ejectors and other auxiliaries in a compartment below. The four propeller motors occupy three watertight compartments in the stern, the two inboard motors being in one, and an outboard motor in each of the other two. No other apparatus is in the motor compartments. The control room from which all of this machinery is controlled is also separate and watertight, and is aft of the turbines and forward of the two inboard motors.

TURBINES

Each turbine generator unit consists of a single Westinghouse steam turbine directly connected to a 3-phase alternating current generator, rated at 15,000 KVA for continuous operation and delivering 3,400-volt, 36-cycle current, at full speed.

The turbines are of the impulse and reaction type, and per-

mit the complete expansion of the steam in each cylinder. They are designed to take steam at 250 pounds gage pressure at the throttle, 50 degrees superheat, and 28½ inches vacuum. The steam, on entering the turbine, is first expanded in a set of nozzles, and then passes through a 2-row impulse wheel and through a high pressure reaction stage. It then divides, and the two parts pass through low pressure reaction blading on opposite ends of the rotor, and exhaust into the condenser.

The speed of the turbine can be varied over a range of from 1,500 to 2,200 revolutions per minute by means of a manually operated governor. This governor is of the centrifugal type, but instead of being loaded by means of a spring, it is loaded by hydraulic pressure, the fluid being oil. The pressure of this oil is regulated by a valve in the control room, so that the turbine speed can be controlled at will from this point. The speed of the turbine depends upon the setting of this valve and will remain constant for a given setting regardless of the load.

The turbine has also an overspeed governor which will automatically shut it down in case of excessive speed. This governor can be manually operated at the turbine or by a wire pull from the control room.

The main generators, which are of Westinghouse make, are similar in design and construction to those used on land, except that special precautions have been taken to protect the windings from salt and moisture. The insulation is of the best known materials and is applied by thoroughly tried methods. Each coil was insulated by the vacuum and pressure method and then given several treatments of varnish and baked after each treatment. On completion, the entire winding was varnished and baked.

GENERATORS

Ventilating air is blown through the stator coils by means of blowers mounted on the rotors, which provide sufficient air to keep the windings cool, under any condition. The air is drawn in at the bottom of the end bell, is forced axially through the machine and is discharged radially through an opening in the top of the frame to ducts leading to the deck.

The rotor is of the totally closed type and is not ventilated internally. It is connected to the turbine by means of a flexible coupling which is enclosed in the bearing housing between the two machines.

The bearings of both the turbines and the generators are lubricated by oil under pressure from motor-driven rotary pumps. Should these pumps fail, similar pumps driven by steam turbines immediately start up automatically, so that no break will occur in the oil supply. Oil for the hydraulic governor is supplied from the same source.

AUXILIARY TURBINE GENERATORS

In each engine room there are three 300-kilowatt direct current turbine-generators, which supply current for light, for operating the various motor driven auxiliary machines throughout the ship, and for exciting the generator fields.

The current for exciting the generator fields is automatically controlled by a small motor generator "booster" set in each engine room. The motor of this set is driven by power

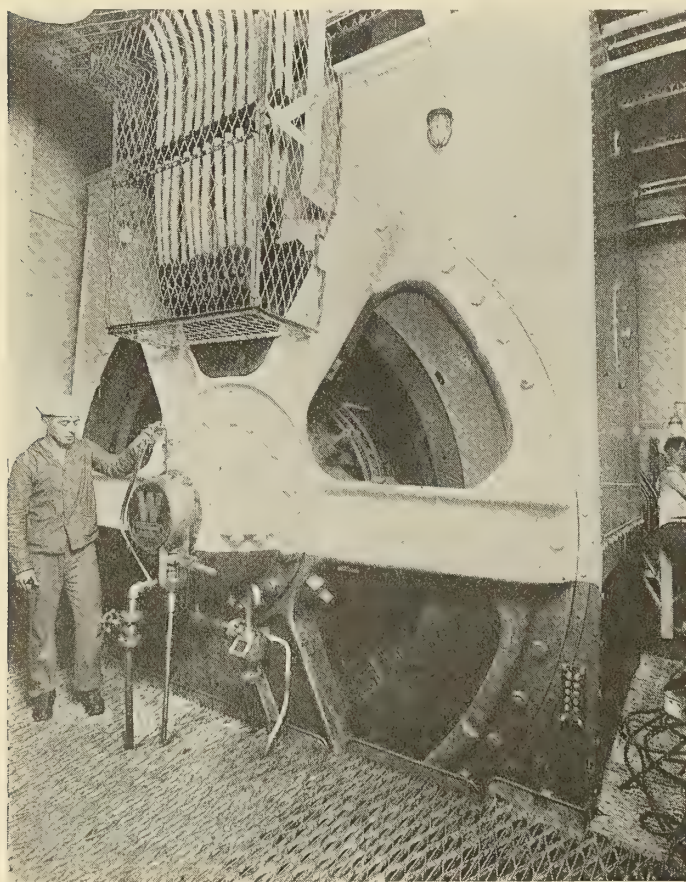


Fig. 2.—One of the Four 8,000-Horsepower Propeller Motors



Fig. 3.—Main Switch Aisle

The four propeller motors are of the Westinghouse induction type, and each is rated at 8,375 horsepower at its maximum speed.

THE PROPELLER MOTORS

In order to provide two speed ranges, each motor can be connected so as to provide either 24 or 36 poles. The primary, or stator, has two independent windings, one for each pole arrangement; while the secondary, or rotor, has a single winding, with cross connections, which forms a polar winding terminating in three slip rings with the 24-pole arrangement, and a squirrel cage winding with the 36-pole arrangement.

The motors are operated at their lowest speed by connecting them for 36 poles and supplying them with power from the main generators operated at their lowest speed, so that for a ship speed of 10 knots, the motor speed is 78 revolutions per minute, and the generator speed is 1,430 revolutions per minute. To increase this speed the speed of the generators is increased, and at the maximum generator speed the motor speed is 118 revolutions per minute and the ship speed 15 knots. To still further increase the ship speed, the motors are connected for their 24-pole winding, and by again varying the generator speed, a range of motor speeds of from 118 to 180 revolutions per minute is obtained, and the speed of the ship is increased from 15 knots to maximum. One turbine generator gives sufficient power up to about 17 knots, while above that speed both are required. This arrangement gives a wide speed range, and at the same time makes it possible to obtain efficient operation of the turbines for both low cruising speeds and full speeds.

The construction of the motors follows standard land practice, with special insulation similar to that of the generator windings. The frames are of the self-contained type, with bearings supported by brackets, and the whole weight of 130,000 pounds is borne by feet cast integral with the frame. The bearings and bearing housings are readily adjustable by means of jack screws in the brackets, and are lubricated by oil under pressure.

The motors are ventilated by means of duplicate motor driven exhaust blowers mounted on top of each motor. Each blower has a capacity of 12,500 cubic feet of air a minute, and draws air through the cores and windings, and discharges it into ducts to the deck. These blowers are assisted by fan vanes on the rotors of the main motors, which can supply sufficient air to permit the motors to be operated at full load for short periods even if the exhaust blowers fail.

A small direct current motor is geared through a clutch

from the auxiliary turbine generators, and the generator of the set bucks or boosts the voltage of the field current to the value best suited to given operating conditions.

PUMPS

The main and auxiliary condensate and circulating pumps, as well as the oil cooler circulating pumps, are motor driven. The vacuum is normally maintained by air ejectors, but as this is the first use of air ejectors for main condensers on a battleship, steam driven air pumps are also installed.

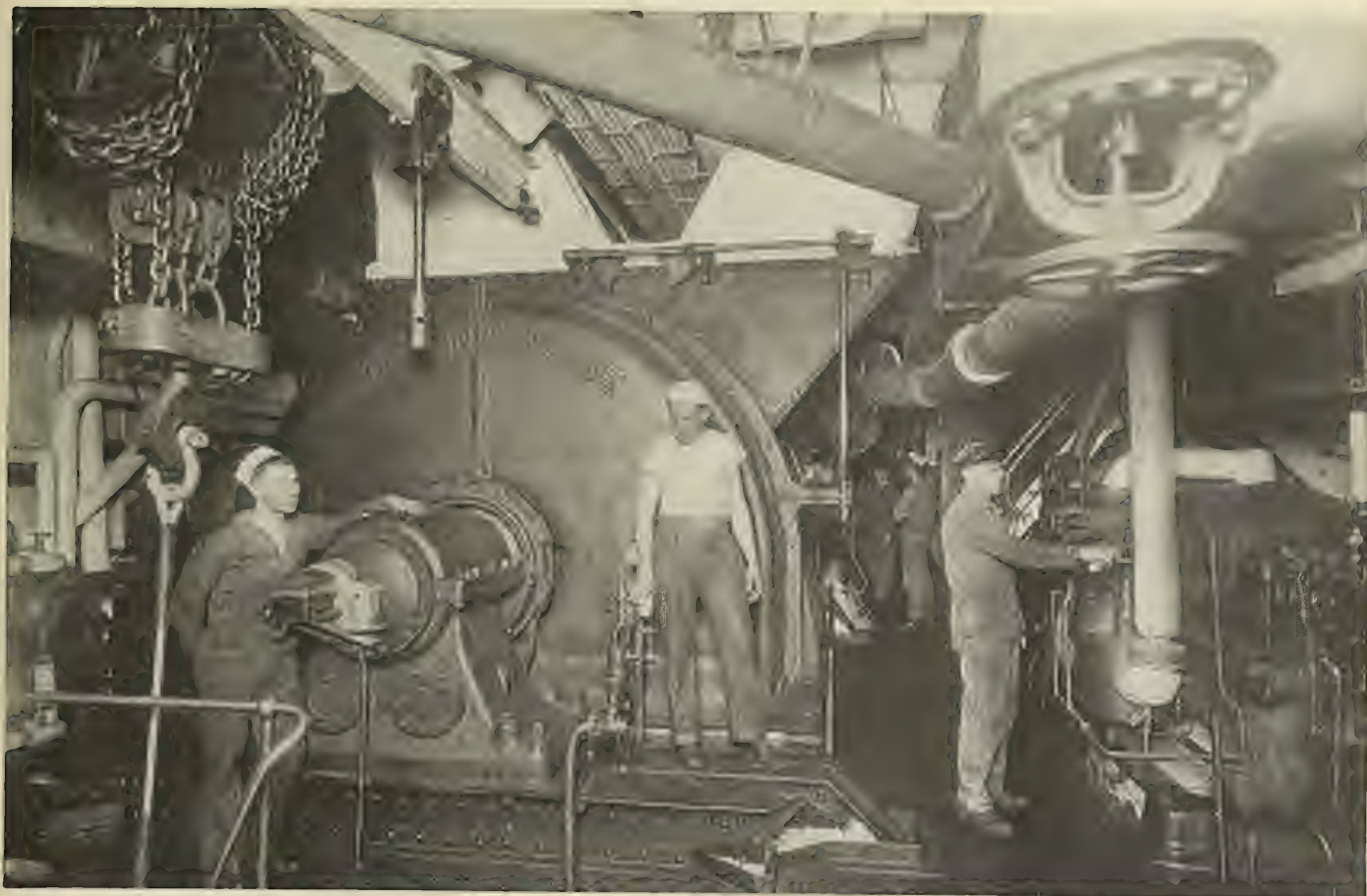


Fig. 4.—One of the Two Main Engine Rooms, Showing 20,000-Horsepower Turbine Generator

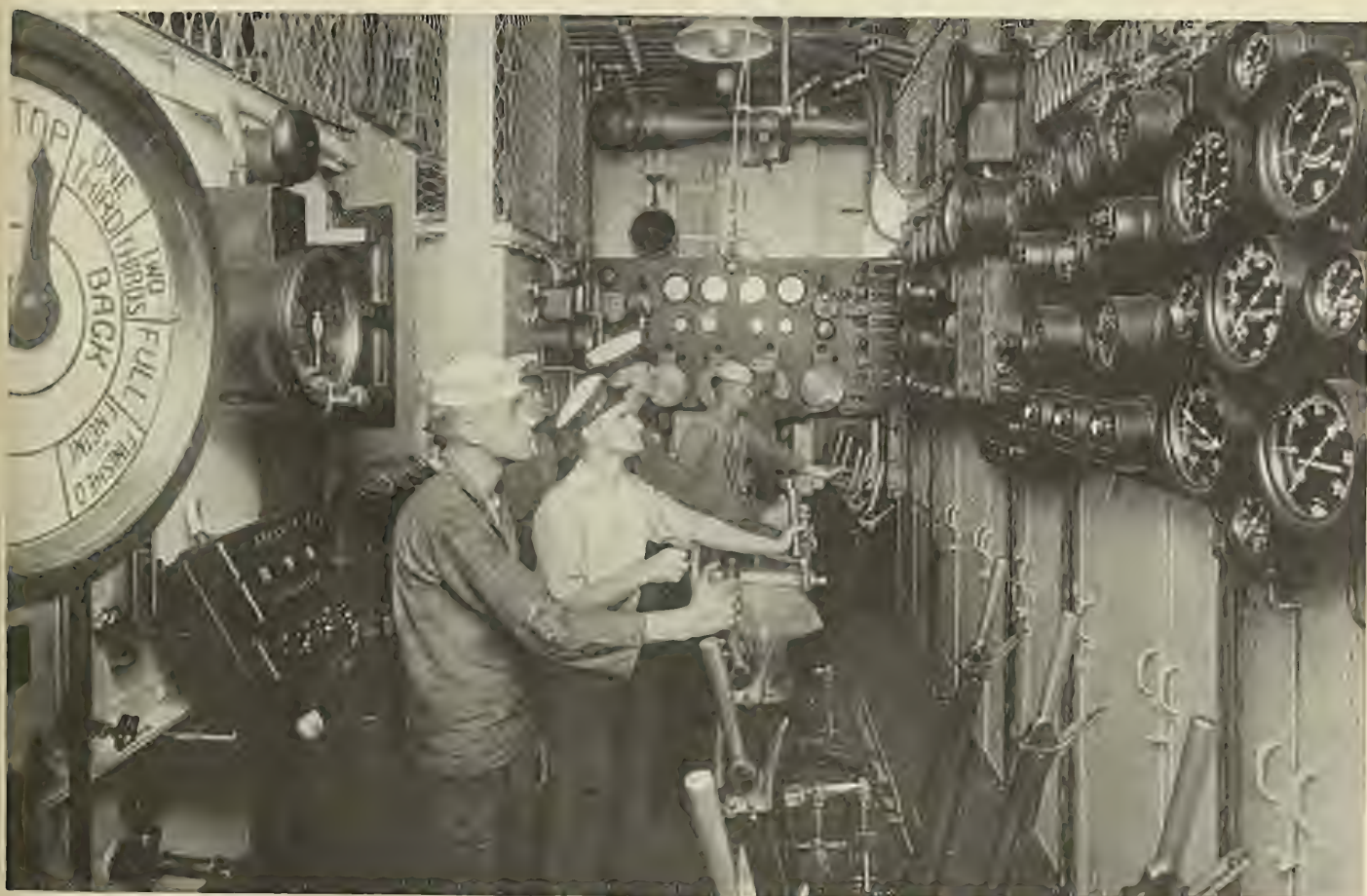


Fig. 5.—Control Room, Located in Center of Ship and Well Protected From Shells and Torpedoes, Where the Entire Control of the Vessel is Centered

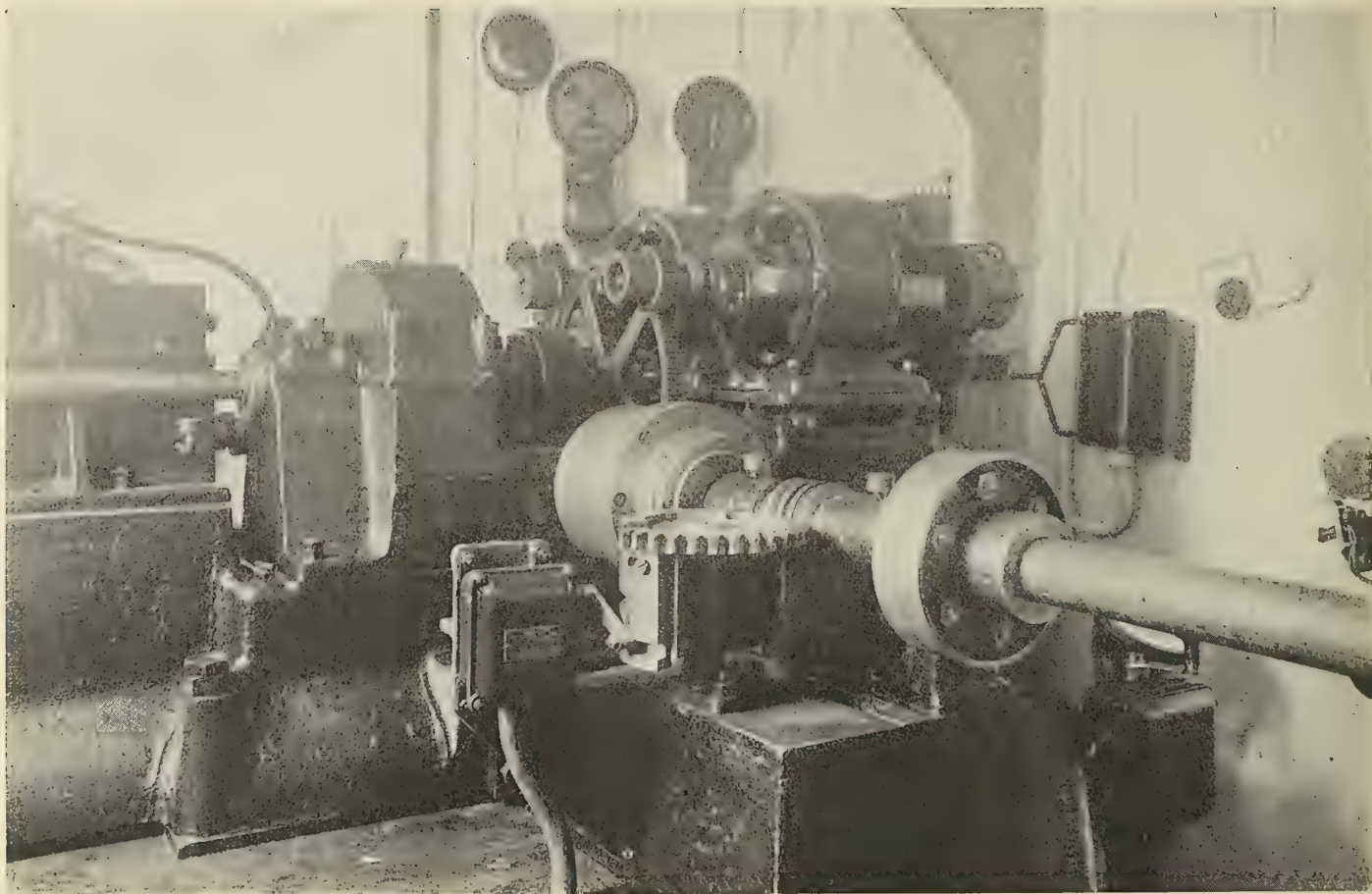


Fig. 6.—Steering Gear and Control Mechanism

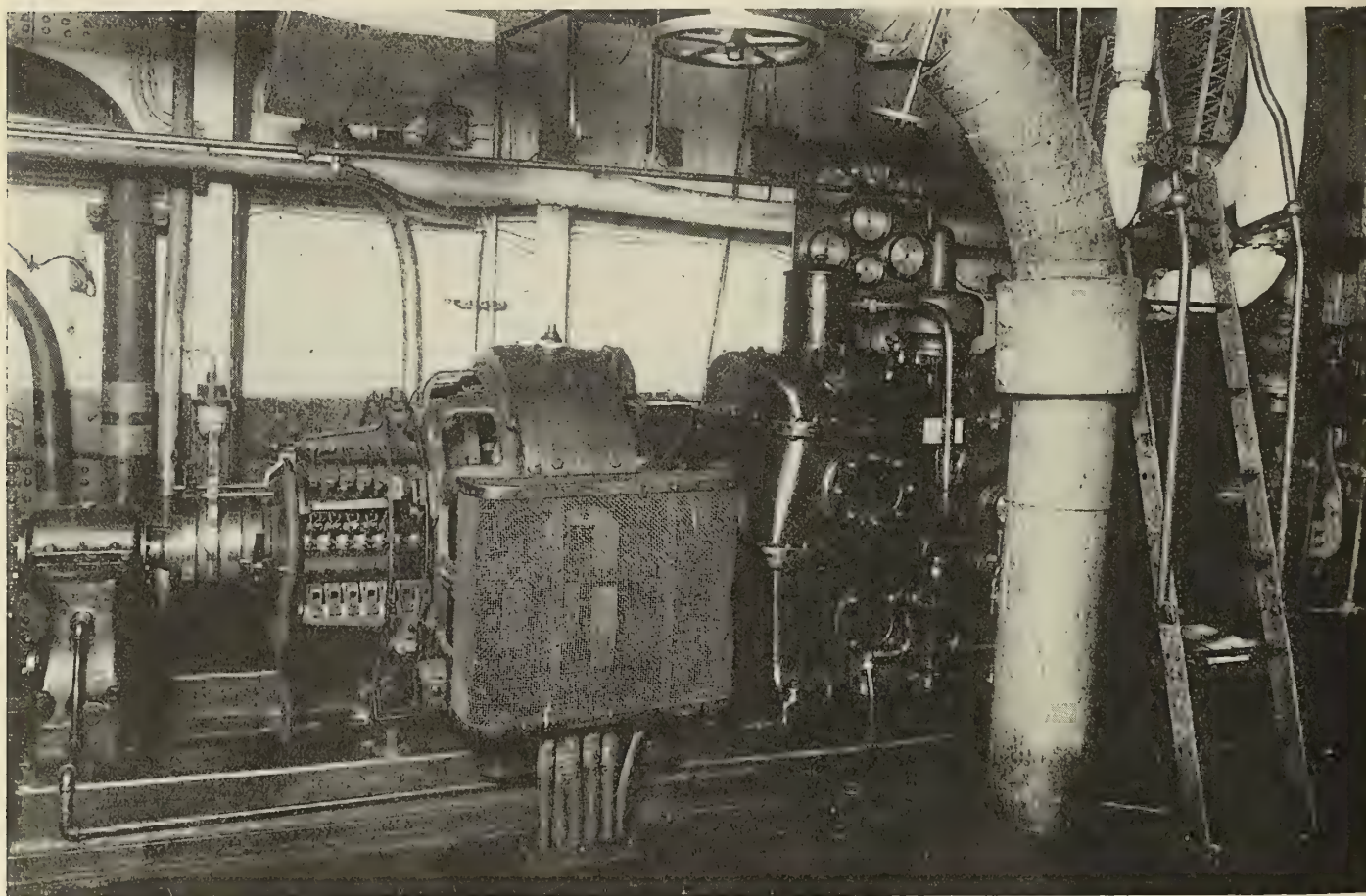


Fig. 7.—One of the Six 300-Kilowatt Direct-Current Turbine Generators That Furnish Light and Power Throughout the Ship

to each propeller shaft and is used to turn the motor rotor and the propeller slowly for inspection or repair.

THE CONTROL ROOM

All of the apparatus necessary for controlling the propelling machinery is located in the control room. The switches are mechanically operated by means of levers, which are arranged in a row down the center of the room. All of these levers are mechanically interlocked so that it is impossible to close or open wrong switches. Facing these levers, in plain sight of the operators, is a set of meters giving full information as to the operation of the machinery and the condition of the various circuits.

All of the switches handling the main high-voltage current are of the oil break type and are capable of being opened safely under full load and voltage, although normally they will not be so opened. The majority of the switches are located in a structure in front of the control board, where they are fully safeguarded with covers but are easily accessible. A special device has been built by means of which the oil tanks of the switches can be easily lowered so as to ex-

pose the contacts. A system of electrical interlocks and disconnecting devices protects the men against possibility of faulty operation, and also makes it possible to render safe for inspection the circuits of any one or two motors while the others are in operation.

The rheostats, used in bringing the motors up to speed when their 24-pole windings are in use, are of the liquid type and are located in the control room behind the control levers. In this type of rheostat, the resistance of the circuit is varied by raising or lowering the level of a solution of sodium carbonate in which electrodes, connected with the leads from the motor secondary circuits, are immersed.

The switches are arranged so that either generator can operate any or all of the motors, and so that the port and the starboard motors can be run in opposite directions, if desired. When both generators are used, each drives two motors, and the two systems are independent.

All of the main turbines, generators, motors, and control equipment, the auxiliary turbo generators, air ejectors, circulating and condensate pumps, and the motors for operating the steering gear and deck winches were manufactured by the Westinghouse Electric & Manufacturing Company.

Submarine S-48 Launched at Bridgeport

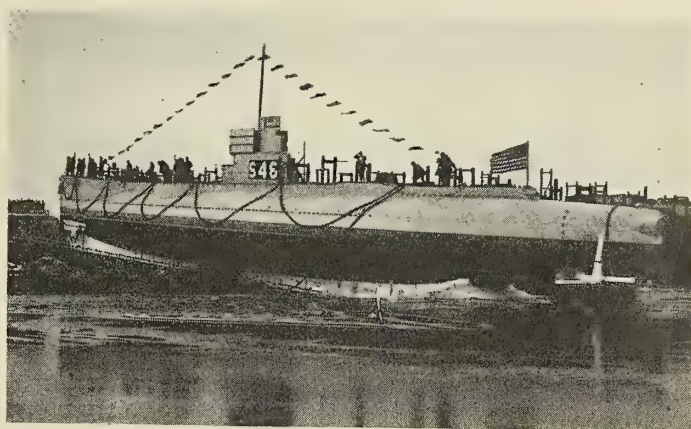
THE submarine S-48 was launched at the yard of the Lake Torpedo Boat Company at Bridgeport, Conn., on February 26. The vessel was christened by Princess Tocomwas, a lineal descendant of Uncas I of the Mohican tribe of Indians, in full Indian regalia. After the launching, the Princess and her party were presented with a miniature submarine by P. B. Brill, general manager of the Lake Torpedo Boat Company.

The S-48 is the first of a group of ten vessels, the design of which embodies the latest developments in submarine construction and, as a result of a delay in awarding the contract until 1919, it contains many improvements over the original "S" type. In order to accommodate the new features the length and displacement of the vessel were increased over the original design. The principal dimensions are as follows:

Length overall	250 feet
Breadth, maximum	22 feet
Draft, in normal surface condition.....	13 feet 6 inches

She has a displacement of 993 tons; has the double hull type of construction for one-half length amidships; the forward and after hull portions being of single hull type and the vessel is designed to submerge to a depth of 200 feet with safety.

Four 21-inch torpedo tubes are installed in the bow and one 21-inch torpedo tube in the stern. A four-inch, fifty-caliber gun will be located on the deck forward of the conning tower, a special hatch being fitted to provide access for the gun crew to reach the gun. Three periscopes will be fitted,

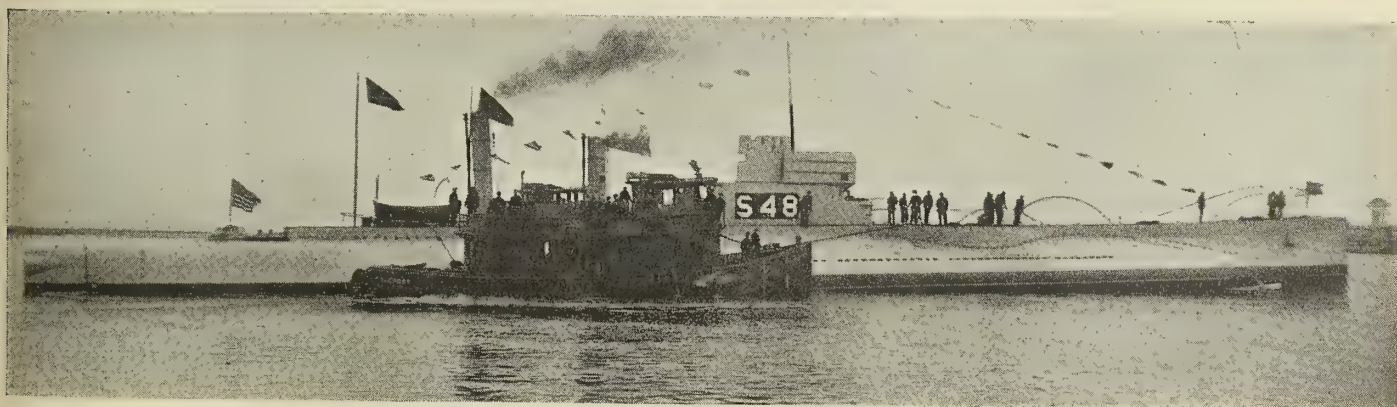


The S-48 Going Down the Ways

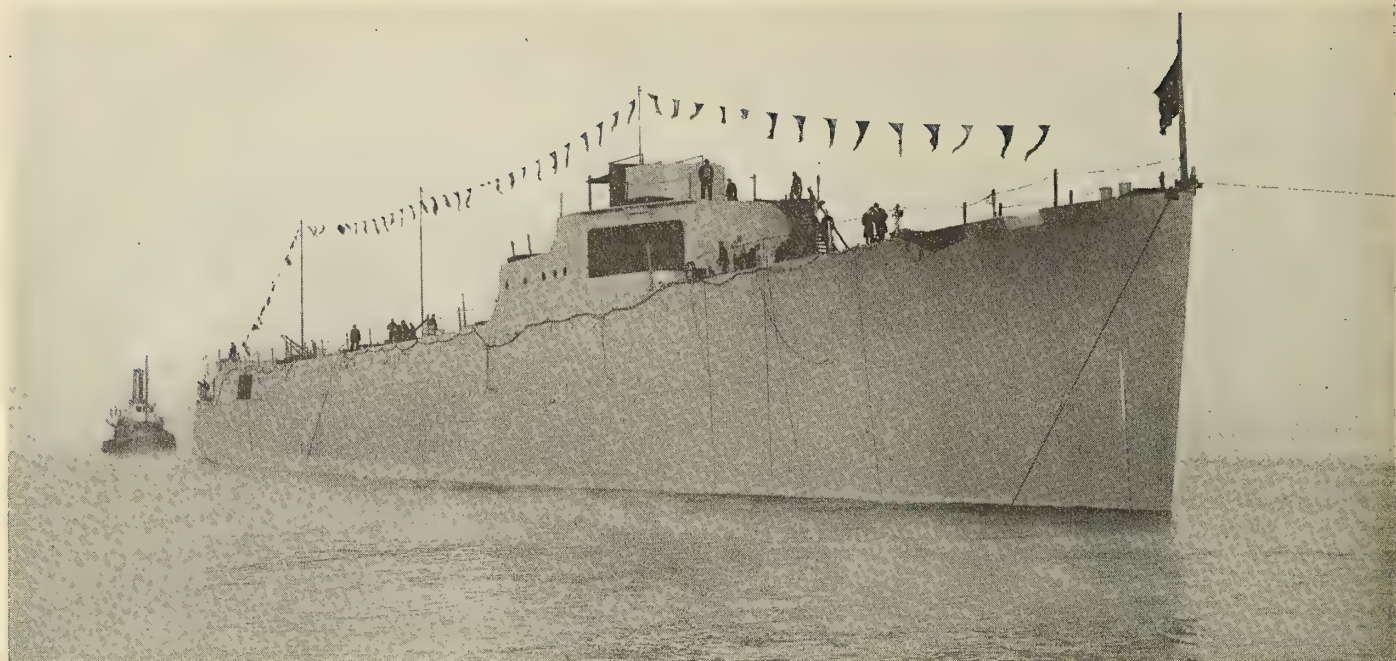
one of which has its eye piece in the conning tower and is arranged with a platform which rides up and down with the periscope.

The vessel will be propelled on the surface by two Diesel engines of 950 brake horsepower. The vessel has twin screws, each engine driving its own propeller. When the vessel is submerged propulsion is obtained by two powerful electric motors.

A submersible radio apparatus is to be fitted which is designed to work when the vessel is submerged or running on the surface. Submarine coils will be installed for receiving radio messages when submerged.



United States Submarine S-48 Afloat After Launching



Scout Cruiser Omaha, Starboard Bow, After Launching, December 14, 1920

Our New Scout Cruisers

BY LIEUTENANT COMMANDER D. F. DUCHEY, U. S. N.

In December of last year, there were launched at the Tacoma plant of the Todd Dry Dock and Construction Corporation the first two of ten light cruisers building for the United States Navy. These were the Omaha and Cincinnati; the other eight are the Milwaukee, Raleigh, Detroit, Richmond, Concord, Trenton, Marblehead and Memphis. One of the latter is building at Tacoma, two are under construction at the Fore River Plant of the Bethlehem Shipbuilding Corporation, Ltd., and five at the Philadelphia yard of Wm. Cramp & Sons Ship & Engine Building Company.

WHILE the hull construction and armament of our new scout cruisers embody many features that are new and undoubtedly of much interest, the purpose of this article is to deal primarily with the main propelling units installed within the machinery spaces, only such mention being made of auxiliary units, as ice machines, etc., as will lead to a clearer understanding of the layout in general.

These vessels, displacing 7,100 tons, have an overall length of 555 feet, on extreme breadth of 55 feet 4 inches and a mean draft of 13 feet 6 inches. At full power, a speed of 35 knots with a corresponding horsepower of 90,000 is expected. This 90,000 horsepower is divided among four shafts, each shaft being driven through gearing by a combination of turbines that provides the requisite speeds ahead and astern in the most economical manner.

The main turbines with their necessary auxiliaries are located in two watertight compartments. The necessary steam is supplied by twelve express type boilers located in four watertight compart-

ments. These boilers are fitted for the use of fuel oil only. The boiler auxiliaries, with the exception of the main feed pumps, are located in the firerooms.

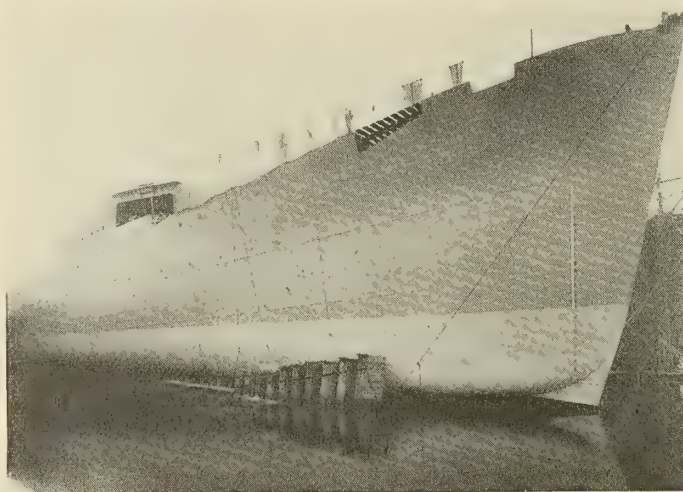
MACHINERY ARRANGEMENT

The general arrangement of engineer compartments, from forward aft, is as follows: Number one fireroom, number two fireroom, number one engine room, number three fireroom, number four fireroom and number two engine room. The

two outboard propellers are driven from number one engine room and the two inboard shafts from number two engine room.

The main units of the individual vessels, while generally alike in arrangement, differ in details, the units being supplied by different firms. The vessels building at Tacoma will be equipped with Westinghouse turbines and Westinghouse gears; the Cramp vessels with Parsons turbines and DeLaval gears; and the Fore River vessels with Curtis turbines and Falk gears.

The Westinghouse ar-



Scout Cruiser Omaha Launching Cradle, Starboard Bow

range consists of four 22,500 horsepower cross compound Westinghouse turbines, the high and the low pressure elements being in separate casings; the low pressure casing contains the backing turbine, the cruising turbines are separate. A detailed description of these units having been published in the February issue of MARINE ENGINEERING, page 121, further details are omitted.

The Cramp installation consists of the usual Parsons combination, one high pressure turbine and one low pressure turbine connected through gearing to each shaft. The astern turbine is carried in the low pressure casing. There are two cruising turbines connected through gearing to one port and one starboard shaft. The shafts of the cruising gear wheels are fitted with power clutches. When operating on the cruising combination, a speed of over 15 knots is required. For cruising speeds, steam is admitted into the cruising turbine and thence through the cruising stages of the high pressure turbines in the same compartment. The cruising and high pressure turbines are direct flow, while the low pressure turbines are of the double flow type.

The Fore River installation is similar to that adopted for destroyers and consists of Curtis turbines, one high and one intermediate pressure turbine in series and one double flow low pressure turbine connected by gearing to each main shaft. As in the other installations, the astern turbine is in the same casing as the low pressure turbine; there are no cruising turbines. In order to obtain the equivalent economy that would exist were cruising turbines installed, recourse is had to fitting special nozzles on the steam chests of the high pressure turbines.

BEARINGS

In all types of turbines installed necessary connections for utilizing the excess auxiliary exhaust are installed, as likewise the latest and most approved methods for checking and adjusting clearances.

The unbalanced steam thrust of the turbines will be taken

by thrust bearings of the pivoted segmental Kingsbury type. The propeller thrust will be taken by similar bearings located at the ends of the main reduction gear casings. The spring bearings are of the self-aligning, self-oiling, water cooled type. The thrust bearings and main bearings will be lubricated under pressure.

PROPELLERS

The propellers, which will be cast solid, are approximately eleven feet in diameter, with a pitch of twelve feet and a projected area ratio of 0.60. At full power, they will make about four hundred revolutions.

REDUCTION GEARING

The speed reduction gears, which are the largest yet installed in our service, are of the toothed gear type, the two driving pinions on each unit meshing directly with the gears. The speed reduction ratio varies from 6.3 to 1 to 7 to 1 on the various types and is effected in a single step. Both pinions and gear wheels are of the double helical type, the pitch and teeth angles varying with the

types. Where considered necessary, the teeth are thinned and chamfered.

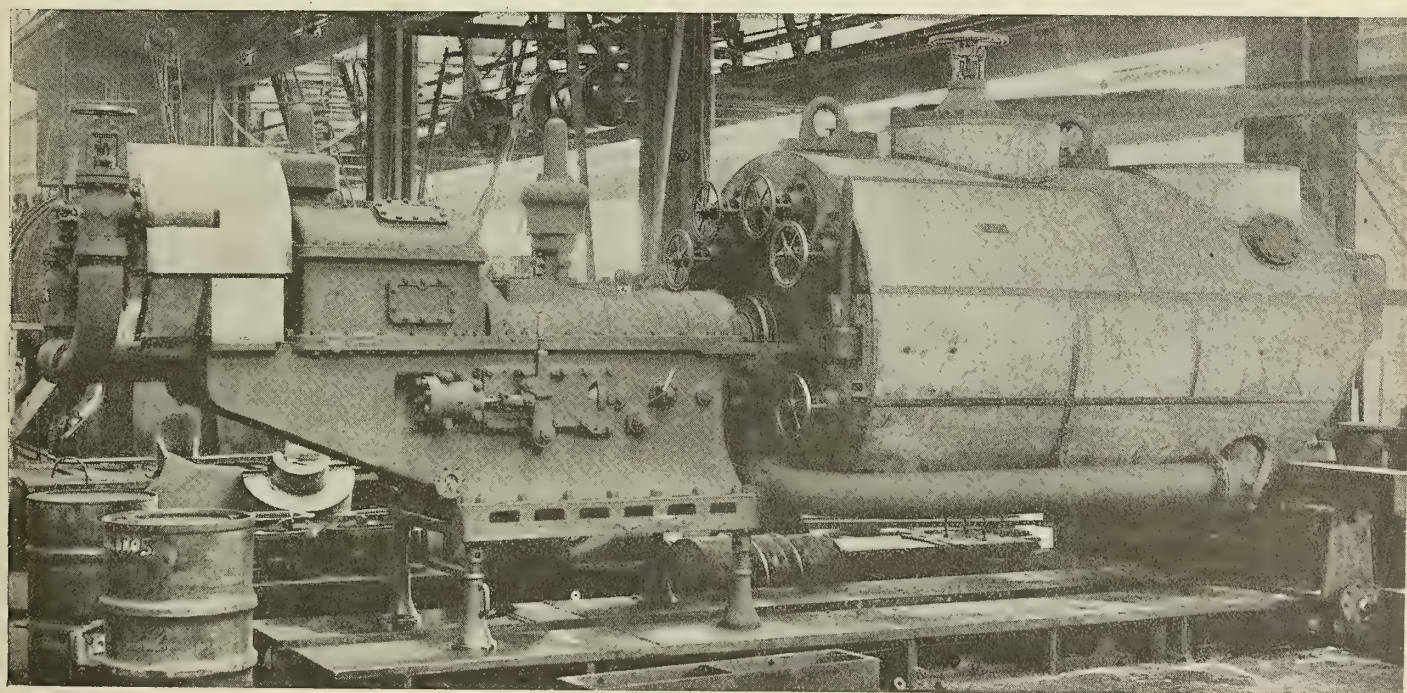
BOILERS

Five vessels have Yarrow and five (Cramps) have White Forster boilers, twelve to a vessel, with an aggregate heating surface of 90,000 square feet. The furnace volume is approximately 800 cubic feet and the working pressure 265 pounds gage. The boilers are equipped for burning fuel oil only and are capable of supplying an excess of steam.

FUEL OIL BURNING APPARATUS

The fuel oil burning apparatus for the Bethlehem vessels will be of the Bethlehem type, nine registers, complete with atomizers, to a boiler. These nine registers are capable of burning approximately eleven thousand pounds of oil per hour. The Cramp vessels will be fitted with Bureau of Engineering type forced draft registers and atomizers, fourteen registers to a boiler. The Todd vessels will be equipped

The new scout cruisers, with their tremendous horsepower, their high speed and sea keeping qualities, represent a type unique in the floating world. And when it is considered that in these 7,100-ton hulls, drawing less than fourteen feet of water, there is contained machinery that will develop over 90,000 horsepower, a power equal to that of four modern destroyers, one familiar with modern ship construction can well understand the difficulties met with in construction.



One of the Main Propelling Units of the Omaha

with the Babcock and Wilcox "Lodi" type register and atomizer, six to a boiler, each register being capable of burning two thousand pounds of oil per hour.

This last mentioned atomizing apparatus is at least three times the capacity of any yet used on board ship and is the forerunner of what is hoped to be a development of considerable importance in the fuel oil burning field. Some idea of the capacity of these registers may be obtained when it is considered that one of them will burn in one hour the equivalent of the amount of coal a house owner uses in a month.

AIR SUPPLY

In order to supply air to support the existing high rates of combustion, twelve turbine driven forced draft blowers are installed in each vessel. The closed fireroom system will be used, three blowers to a fireroom. Each blower will be capable of supplying fifty thousand cubic feet of air at a pressure of seven and one-half inches of water. The steam consumption of these twelve blowers will amount to over seventy thousand pounds per hour.

FUEL OIL STOWAGE

The fuel (only oil will be carried) will be stored in tanks located forward and aft of the engineer compartments. Provision is made for fueling both in port and at sea and for supplying smaller craft. Each tank is fitted with heating coils, suction and discharge piping and drains, and the whole is so piped that any tank can be used as a supply to any boiler. Tank clinometers, air vents and other safety apparatus will be installed.

CONDENSER AND VACUUM APPARATUS

Each combination of main units will have its own main condenser, each condenser having a cooling surface of approximately eleven thousand square feet. These condensers will be connected directly, via the exhaust trunks, to the main low pressure units, other connections being made as necessary for the auxiliary exhaust and drain lines, etc.

The circulating water for each condenser is supplied by a steam driven, water balanced centrifugal pump having a capacity of eleven thousand gallons per minute. For high speeds, scoops are fitted, the pumps being used only in port and when maneuvering.

To maintain the required vacuum of about twenty-nine inches, air ejectors, air separators and turbine driven centrifugal condensate pumps, with a capacity of five hundred thousand pounds of condensate per hour at a head of sixty-five feet, will be fitted. Each unit is duplicated and so interconnected as to permit of its being used on either condenser in any one engine room. Five of the vessels will be so fitted and the other five will be equipped with the ordinary type air pumps and augmentors (the Parsons system).

There will be two auxiliary condensers, one in each engine room, each having a cooling surface of one thousand square feet. These are capable of handling the exhaust in port. The air pump is of the single cylinder double acting type, and the circulating pump of the centrifugal type.

PUMPS

Each vessel will be equipped with four main feed pumps; these pumps will be in the engine rooms and will ordinarily supply water to the boilers. They will be of the centrifugal type, turbine driven, having a capacity of six hundred gallons per minute at three hundred and ninety-eight pounds discharge head. As a standby, and when it is not necessary to use these pumps, four reciprocating auxiliary feed pumps are provided in the firerooms.

Adequate pumps for the drainage of the various compartments, the handling of fresh water and for use in connection with the distilling plant and ice machines are provided.

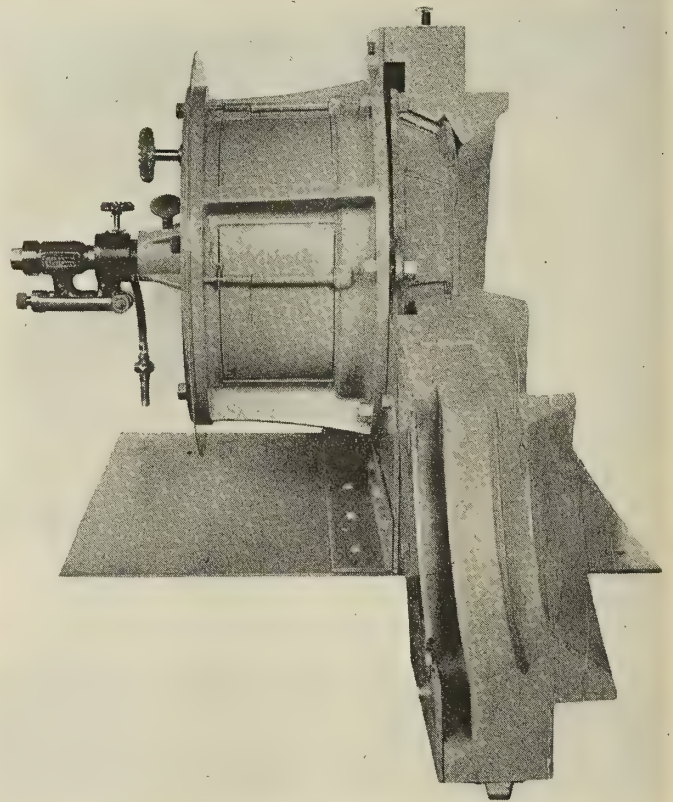
LUBRICATION

Lubrication of the main units is provided for by eight reciprocating pumps. As the closed system is used, the oil is supplied under pressure. Oil coolers, strainers and regulating valves are provided to insure a proper distribution of the oil at the requisite temperatures. The systems are provided with automatic alarms that operate when the oil pressure falls below a predetermined setting.

DISTILLING PLANT

The evaporators, distilling condensers and attendant auxiliaries are located in a separate compartment outside the engine room spaces. There will be four evaporators of the submerged coil type, seven vessels having the Reilly type and three vessels having the Schutte-Koerting type. The feed heaters and distilling condensers will be of a corresponding type.

These evaporators will have a capacity of twenty-five thousand gallons per day and can be operated in either single



Type of Oil-Burning Apparatus Used on the *Omaha*

or double effect. They will provide sufficient water supply to the boilers for steaming purposes, and drinking and washing water for the crew.

ICE MACHINES

In the same compartment with the evaporators will be two 2-ton ice machines. These will provide refrigeration for the cold storage rooms, where the fresh meats and vegetables are carried, will cool the drinking water in the scuttle-butts and will be connected up for freezing ice cream in such quantity that all the crew can be supplied at one time.

The ice making cabinets have a capacity of five hundred pounds a day. Five vessels will have Johns-Manville Audiffren-Singrum machines, and five vessels will be equipped with Clothel machines.

GENERATORS

On five vessels there are installed in each machinery space, on a dynamo flat, one 100 kilowatt and one 50 kilowatt, 125

volt direct current, turbo-generator sets. The 100-kilowatt units consist of a three-stage horizontal Curtis steam turbine running at approximately 3,600 revolutions per minute, at rated capacity, driving a General Electric Company compound wound generator running at 1,200 revolutions per minute, through a Poole turbo three to one reduction gearing; the three units being mounted on a common bedplate. The 50-kilowatt units consist of a two-stage horizontal Curtis steam turbine running at approximately 3,600 revolutions per minute, and direct connected to a General Electric compound wound generator; both units mounted on a common bedplate.

The turbines of both units are designed to operate under normal steam conditions of 250 pounds gage, with maximum steam conditions of 275 pounds gage and to normally exhaust against 25 inches vacuum. When operating non-condensing, they are to exhaust against a maximum pressure of 10 pounds gage.

The machines for the other five vessels will be similarly constructed, but of Westinghouse design.

WORKSHOP

That the vessels may be self-sustaining as regards repairs, a roomy and well-lighted workshop, fully equipped, is provided. This is located clear of the machinery spaces in order to facilitate the handling of work. The workshop will be provided with the following machine tools:

One motor driven, screw cutting, extension gap lathe, seven feet between centers, with motor of the variable speed type and connected by means of gears; one motor driven tool room lathe, four feet between centers; one motor driven column tool-room shaper with a fifteen inch stroke; one upright drill, motor driven, to drill up to one and one-half inches diameter and having twelve inches traverse of spindle; one universal milling machine with an eighteen inch longitudinal feed of table, thirteen inch vertical movement, and eight inch traverse; one two-wheel emery grinder; and three machinist's swivel bottom vises.

In addition to the above, there is all the electric motor driven machinery, such as steering gear, galley appliances, such as potato peelers, dish washing machines, dough-mixing machines, meat and food grinders, and cake machines, that are common to all modern vessels of war.

In ordinary construction perhaps it would be no great feat to install the necessary machinery within such a small space. But with the duplication of units and the protection and sectionalizing required for military reasons, to properly locate the various units and arrange the piping systems so that each and every unit is readily available for overhaul, represents no small task, especially when it is considered that the total weight of machinery will not be far in excess of 1,600 tons.

An Entirely Electrically Welded Vessel*

A RATHER remarkable incident was witnessed on December 29 last at the works of Elektriska Svetsnings Aktiebolaget, Gothenburg, Marieholm, when the first entirely welded ship built in Sweden for practical use, and the second on the European Continent, was launched. The vessel is being built for the above named company's own account and is intended to be a self-propelling electrically welded vessel with arrangement for towing.

The boat is specially constructed for its purpose by Professor A. H. Lindfors. It has a flat bottom, which extends at both ends right up to the waterline, but its appearance on the water does not differ much from our ordinary type of tugboats. The total length of the vessel is 52 feet 6 inches, the breadth 13 feet 1½ inches, the molded depth 7 feet and the draft 3 feet 6 inches.

* Translated from article appearing in *Goteborgs Handels och Sjöfartstidning*, December 31, 1920.

The main part of the vessel is to be occupied by the machinery, which consists of semi-Diesel crude oil engines, intended to drive specially constructed generators for electric welding and also air-compressors. The boat is to be employed in the harbors and neighboring West Coast places in conjunction with the company's other boats for carrying out repairs to ships, whether in the harbor or in dry docks or at the respective shipbuilding yards.

The most interesting feature, however, is the absence of rivets which is noticeable at the first glance at the boat, and still more striking, when on board. Apart from the two rubbing bars, the sides as well as the bottom are smooth and glossy as if cast in one piece, which, in fact, due to the welding is practically the case. The same is true of the deck, hoods, beams, bulkheads and frames, the last named being connected with the plating even more strongly than demanded by Lloyd's Register for welded ships.

The boat is built under special survey of Lloyd's Register, Bureau Veritas, and the Swedish Government Inspection.



Self-Propelled Electrically Welded Vessel

The engine room skylight is the only part of the whole ship that is made removable, bolts have been used. Otherwise the vessel is welded throughout, having a total length of welds of 5,655 feet on different thicknesses of metal.

On the Continent the first entirely welded ship was built in 1919 by the licensees of the "Kjellberg" system in France, at the S. A. F. (La Soudure Autogene Francaise) in Paris. The vessel was built at Caen and is similar to the above named boat, and for the same purpose, although somewhat larger. It is stationed in the harbor of Le Havre.

It is assumed that the Swedish shipbuilding industry, with which Mr. Kjellberg is closely related, will take considerable advantage of the experience gained during the building of this boat.

Naval Architects' Meeting in London

AT the annual meeting of the Institution of Naval Architects, held in London on March 16, 17 and 18, the following papers were read and discussed: "Notes on Some Features of German Warship Construction," by Sir Eustace D'Eyncourt, K. C. B.; "Ex-German Battleship *Baden*," by S. V. Goodall, M. B. E., R. C. N. C.; "The Strength of Submarine Vessels," by W. R. G. Whiting, M. B. E.; "Mechanical Gears of Double Reduction for Merchant Ships," by R. J. Walker, C. B. E., and S. S. Cook, B. A.; "Life-Saving Appliances on Cargo and Passenger Vessels," by E. W. Blocksidge; "The Design of Balanced Rudders of the Spade Type," by M. E. Denny, C. B. E., S. B.; "Standardization of Data for Airship Calculations," by H. B. Wyn Evans, R. C. N. C.; "A Study of the Framing of Ships," by Professor T. B. Abell, O. B. E., M. Eng.; "On the Spacing of Transverse Bulkheads," by K. G. Finlay; "Deflections of Bulkheads and of Ships," by A. M. Robb, B. Sc., and "Some Experiments on Tallows in their Use for the Launching of Ships," by J. J. King-Salter, R. C. N. C.

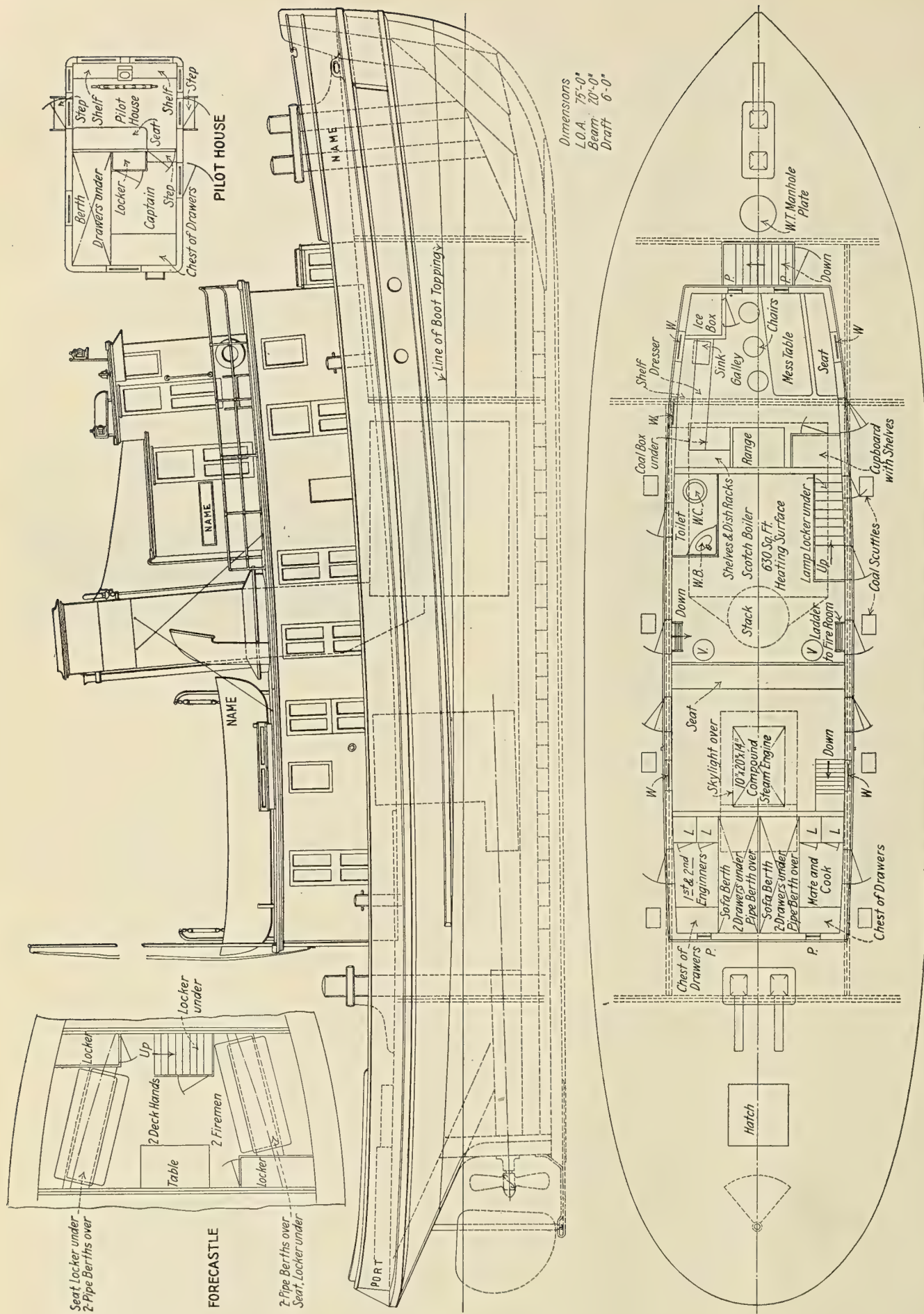


Fig. 1.—Profile and Main Deck of 75-Foot Wooden Tug Designed by Tams, Lemoine & Crane, New York, for Service in the Tropics

Wooden Tug for Service in Tropics

DESIGNS have been made by Tams, Lemoine & Crane, naval architects, 52 Pine street, New York City, for a wooden tug to be used for towing work in the waters about Cuba. She will be of heavy construction with the bottom coppered and was designed for classification by the American Bureau of Shipping.

The main propelling machinery will consist of a compound engine of about 150 indicated horsepower. Steam will be generated in a single boiler of the Scotch type fitted for coal burning. All fittings and auxiliaries necessary to the best economy will be installed, including an electric light plant of suitable size. A bunker capacity of 30 tons has been provided and arrangements made for carrying 10 tons of boiler feed water.

The harbor in which the tug is to operate has a depth of water of about 7 feet along-side the docks and for this reason the tug was designed for a maximum working draft of 6 feet.

The tug is 75 feet long overall with an extreme beam over the fenders of 20 feet. The framing is of white oak in short lengths, the side frames tapering from 8½ inches at the bilge to 6 inches at the main deck. The floor timbers are 10 inches deep at the keel. The keel is of white oak 8 inches by 12 inches and the main keelson of yellow pine 12 inches by 12 inches. The deck beams are of yellow pine 5 inches by 8 inches spaced 24 inches. The bilge stringers are of yellow pine.

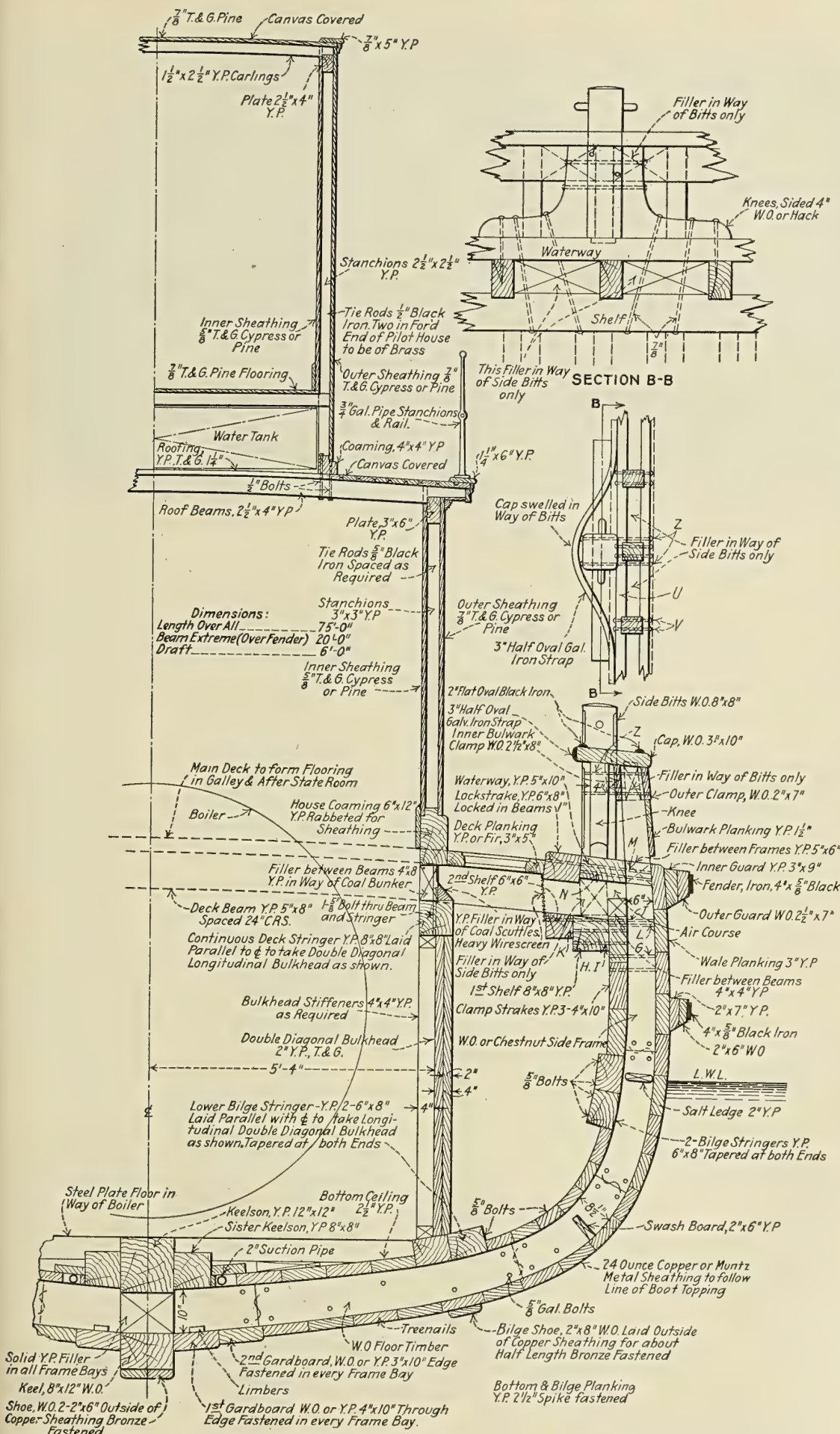


Fig. 2.—Midship Section of 75-Foot Wooden Tug



Fig. 1.—New 7,000-Ton Motorship *Tosca*, Owned by Winge & Company, Christiania. The First of Four Vessels for the Same Owners. Fitted With Two 1,400-Horsepower Werkspoor Oil Engines

Motorship *Tosca*

Description of a Modern Twin Screw Cargo Vessel Designed and Built in Norway

A RECENT addition to the growing list of motorships is the *Tosca*, which was built by the Nederlandsche Scheepsbouw Maatschappij of Amsterdam and engined by the Werkspoor Engine Works, also of Amsterdam.

The *Tosca*, which was built to the account of Winge & Company of Christiania, is of the following principal dimensions:

Length between perpendiculars.....	114.300 meters
Breadth.....	15.620 meters
Depth to main deck.....	7.770 meters
Depth to spar deck.....	10.360 meters
Draft loaded.....	7.342 meters
Deadweight capacity.....	6,990 tons
Displacement.....	10,260 tons
Speed, loaded.....	11 knots

The vessel was built in accordance with the rules of the Norske Veritas and to the Norwegian Law.

ACCOMMODATIONS

Passenger accommodation, consisting of six spacious two-person cabins and two saloons, provides for carrying twelve passengers. These are located in the bridge deck house and above are the captain's room, wheel house, chart house and Marconi station.

Deck officers and engineers are housed in a deck house erected about the engine room shaft and the crew accommodations are located in the poop.

HULL

The fore part of the vessel is specially reinforced to permit forcing its way through ice.

The hull contains two continuous decks. There are two pole masts, one kingpost, one funnel and five cargo hatches.

Steel corn bulkheads are provided on the centerline, forward and aft of the hatches, and arrangements made to allow wooden partitions being fitted between the steel bulk-

heads in such a way that a midship bulkhead is formed when carrying corn cargo.

A double bottom extends over a large part of the vessel's length and arrangements are made for carrying fuel oil or water ballast. The space between the shaft tunnels is fitted as an oil bunker and smaller bunkers are also fitted outboard of the tunnels. Fresh water is carried in three large tanks located 'tween decks amidships.

MAIN PROPELLING MACHINERY

The main propelling machinery consists of two, direct reversible, Werkspoor marine Diesel engines. Each engine has six cylinders 560 millimeters in diameter by 1,000 millimeters stroke and develops 1,400 indicated horsepower at 125 revolutions per minute. This provides a speed for the vessel of 11 knots at a fuel consumption of 9 tons per day.

AUXILIARY MACHINERY

The auxiliary machinery consists of the following:

Three main electric generating sets, each consisting of a 50-kilowatt, 220-volt generator direct connected to a 2 cylinder, single acting, four cycle Werkspoor Diesel engine. The engine develops 100 horsepower at 250 revolutions per minute, each cylinder being 320 millimeters in diameter by 450 millimeters stroke.

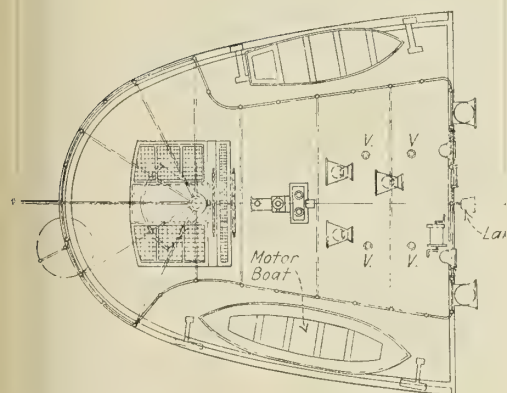
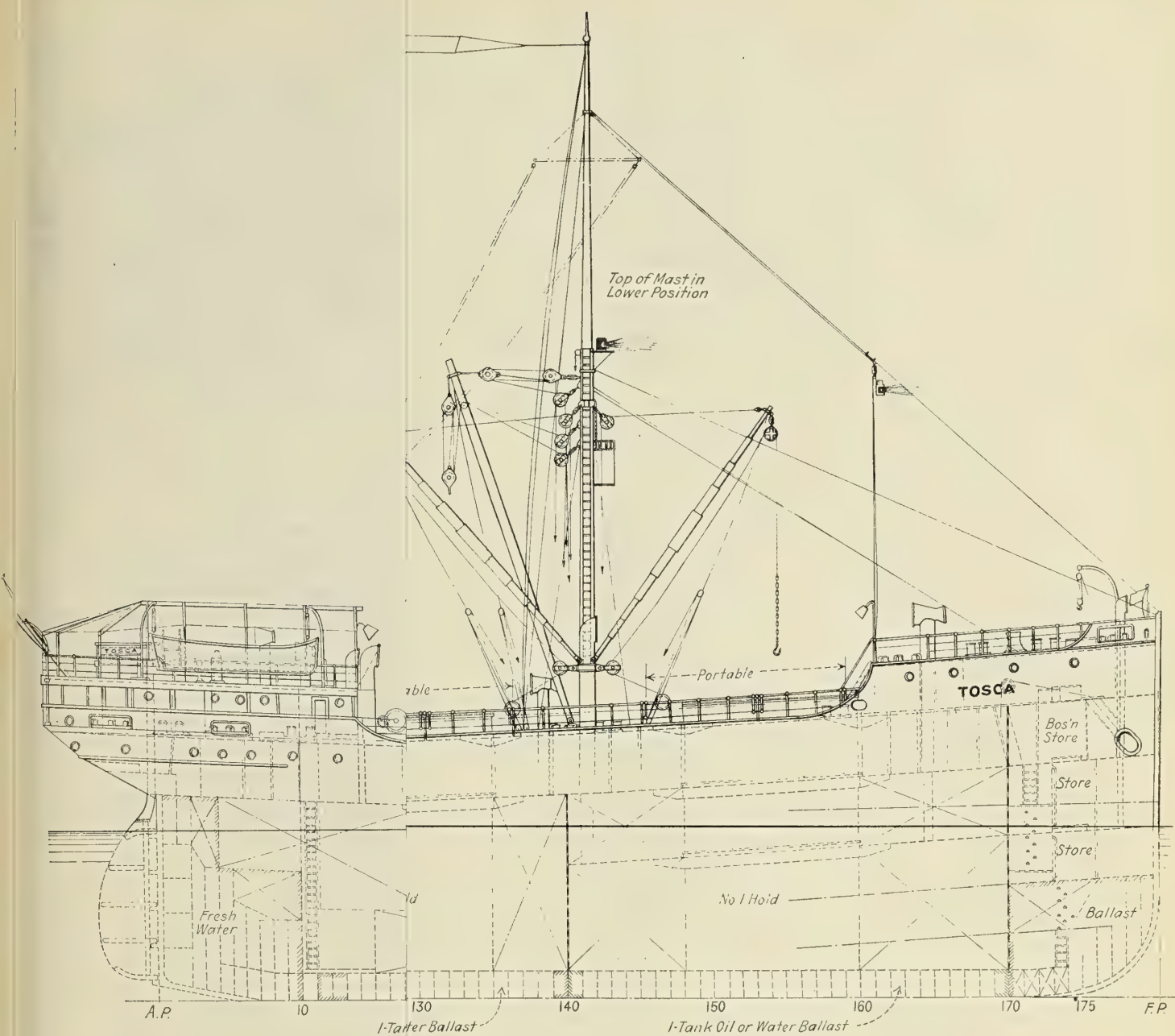
An air compressor, to deliver air at a pressure of 1,000 pounds per square inch, direct connected to an electric motor of 90 kilowatts output at 275 revolutions per minute.

An electric driven, centrifugal, cooling water pump with a capacity of 150 tons per hour at 975 revolutions per minute.

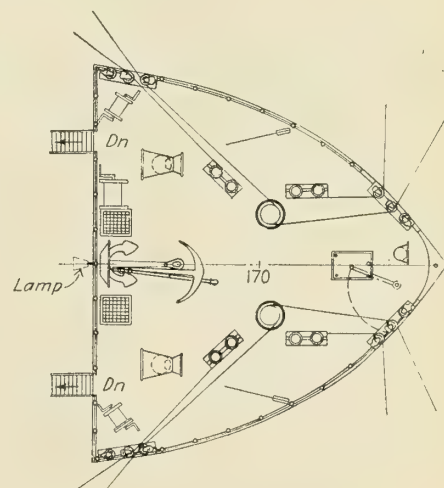
An electric driven, centrifugal, ballast pump with a capacity of 150 tons per hour at 1,450 revolutions per minute. This pump may also be used as a stand-by for engine cooling and also for deck wash purposes.

An auxiliary oil motor generating set.

A spare lubricating oil pump combined with a spare bilge

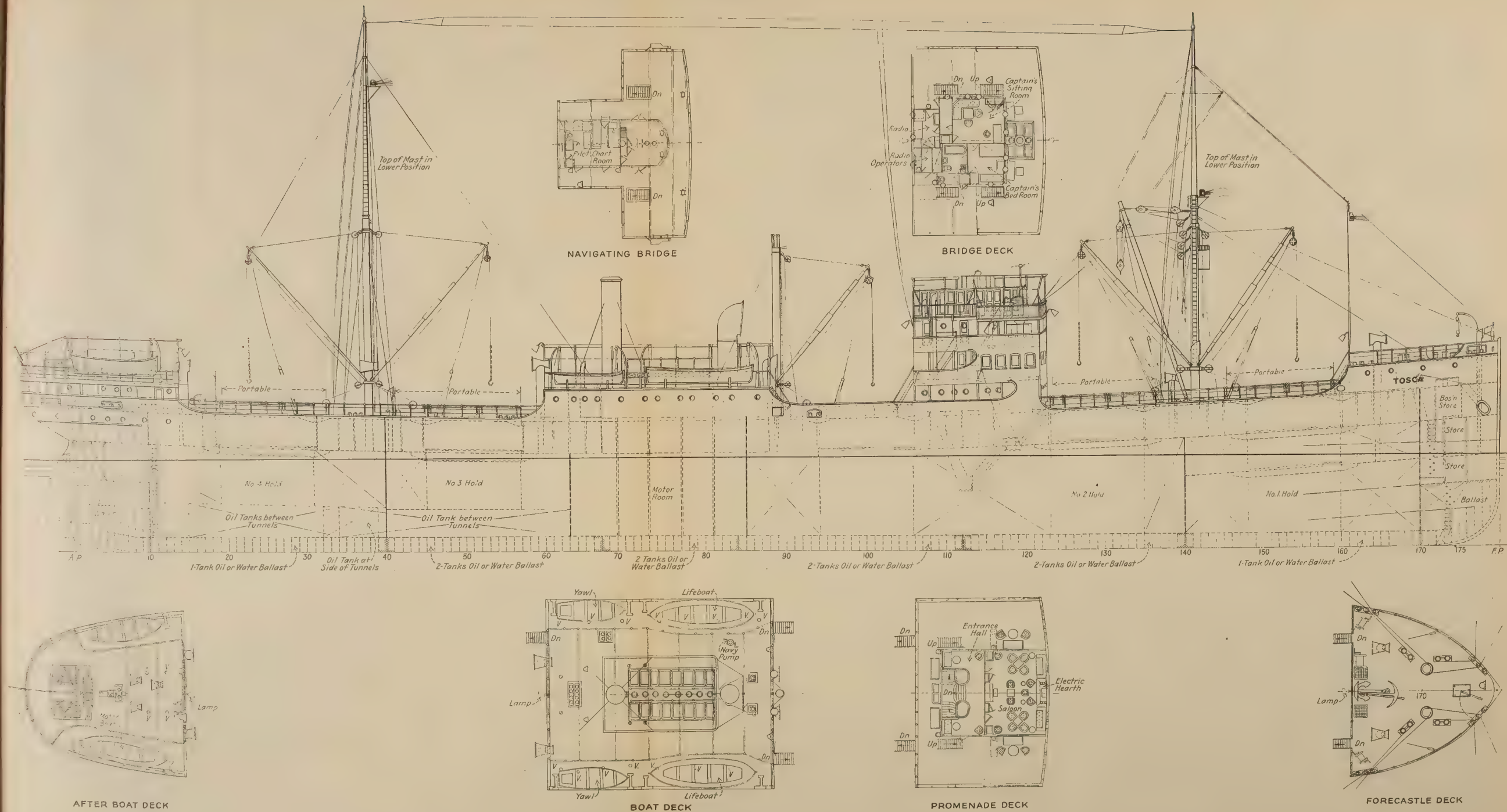


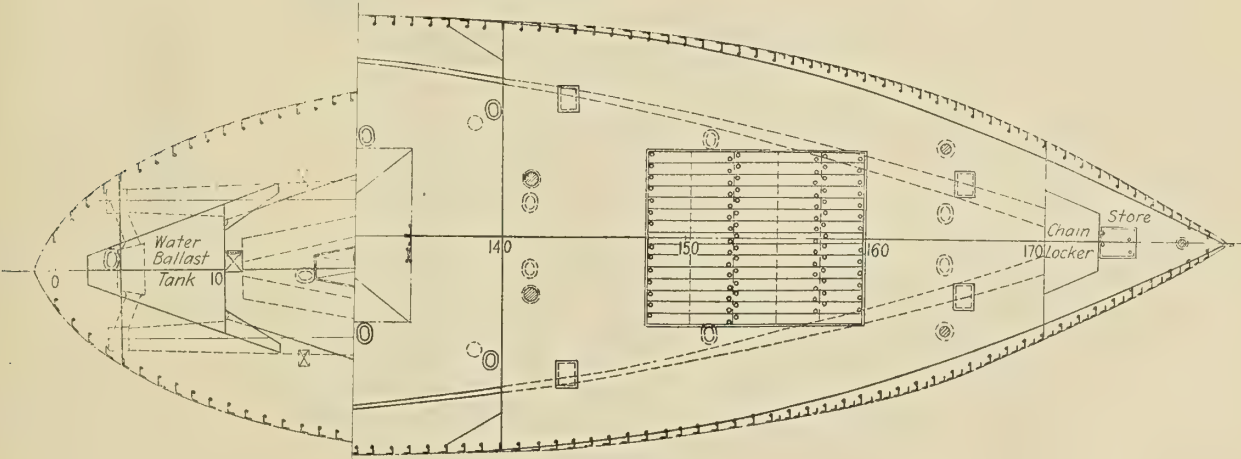
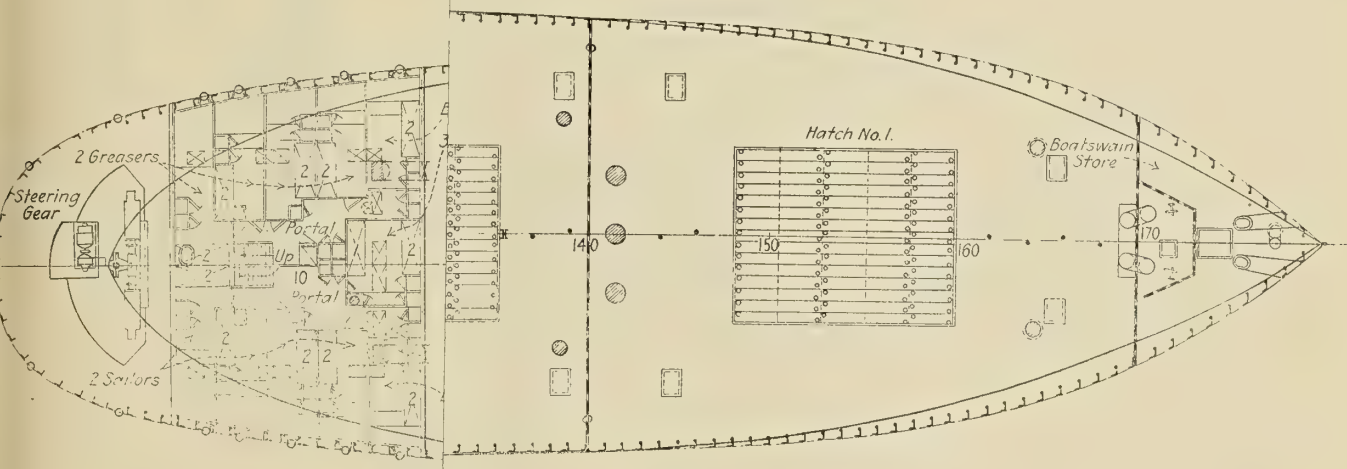
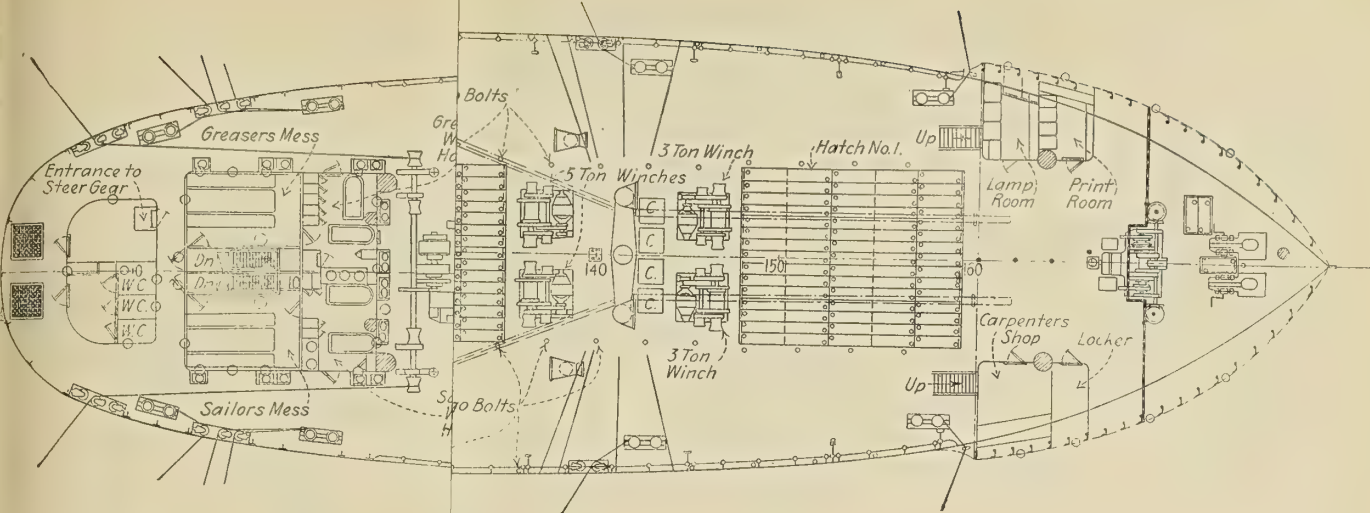
AFTER BOAT DECK



FORECASTLE DECK

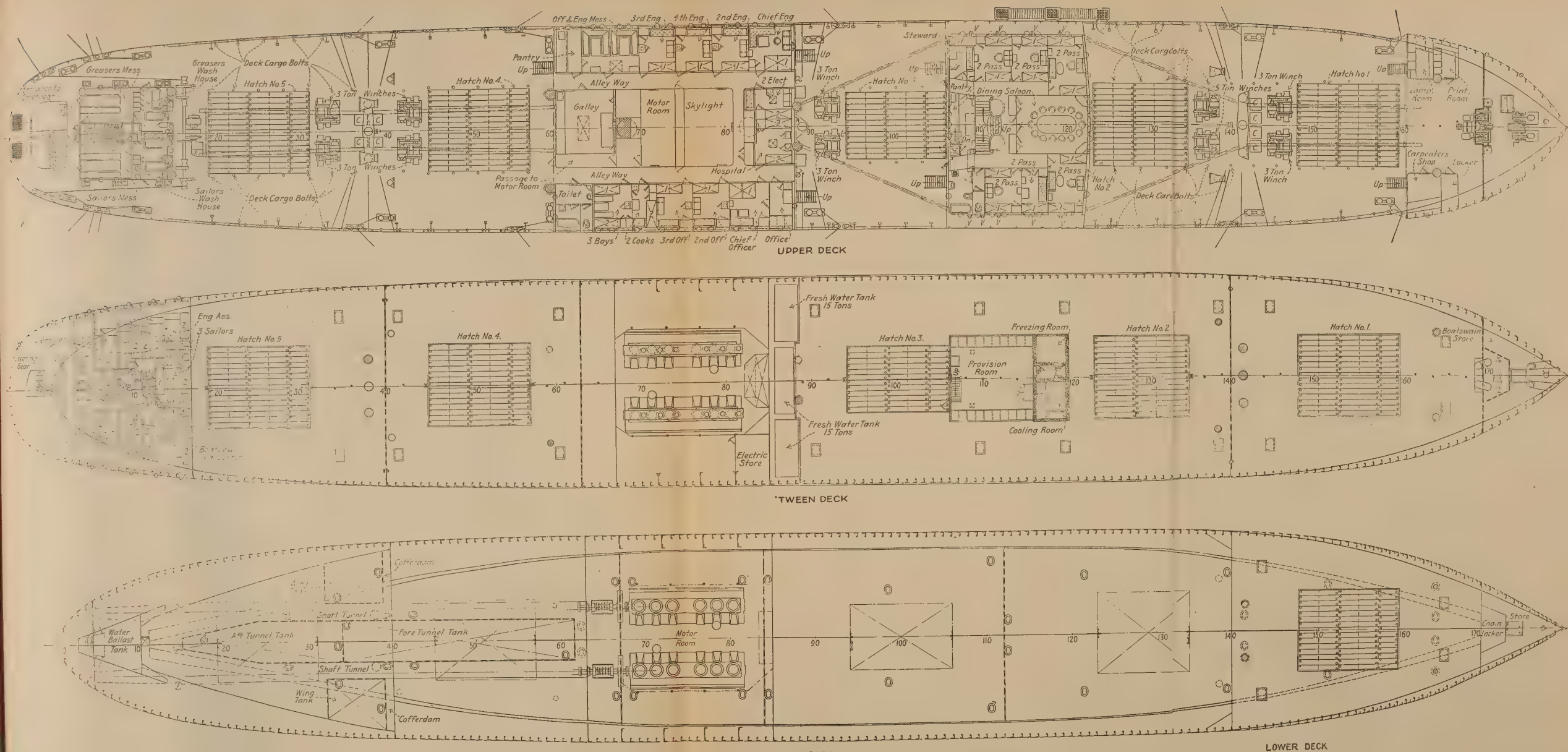
MOTORSHIP TOSCA





LOWER DECK

MOTORSHIP TOSCA



HOLDS
Fig. 3.—Deck Plans

NOTE: All Scantlings are given in millimeters except where noted.

Bridge Deck

Promenade Deck

Upper Deck

Tween Deck

Lower Deck

Deck Beams on every Frame Γ 220 x 75 x 12, Beam Brackets 660 x 660 x 12

Half Beams in Way of Hatches Γ 180 x 75 x 11

Stringer Plate for $\frac{1}{16}$ L 1346 x 15, At the Ends 838 x 8.5, 540 x 540 x 11

Stringer Angle " $\frac{1}{16}$ L 100 x 100 x 14, " 100 x 100 x 10

Deck Plating " 9.5

Hatch End Beam 305 x 12, if Flanged with Flange at Bottom 240 or Γ 200 x 80 x 12

Angle to Deck 75 x 75 x 11

Brackets at Hatch End Beam 915 x 915 x 11.5

Hatch End Plating 10.5, Hatch Side Plating 11.5

Lap 63

6 Rivets, 22 in each Flange

Upper Deck

Deck Beams on every Frame Γ 220 x 75 x 12, Beam Brackets 810 x 810 x 14

Half Beams in Way of Hatches Γ 220 x 75 x 11.5, Brackets 660 x 660 x 11.5

Stringer Plate for $\frac{1}{16}$ L 838 x 10.5, At Ends 838 x 10.5

Stringer Angle " 90 x 90 x 10.5, " 90 x 90 x 10.5

Deck Plating 8

Hatch End Beam 483 x 13, if Flanged with Flange at Bottom 300 or Γ 250 x 90 x 13.5

Angle to Deck 75 x 75 x 11

Brackets at Hatch End Beam 1450 x 1450 x 13 with L 100 x 75 x 11 on the Edge

Hatch End Plating 10.5, Hatch Side Plating 11.5

Lap 63

7 Rivets in each Flange, 22

Tween Deck

Deck Beams on every Frame Γ 220 x 75 x 12, Beam Brackets 840 x 840 x 15

Half Beams in Way of Hatches Γ 250 x 90 x 12, " 690 x 690 x 12

Stringer Plate 838 x 8

Stringer L 90 x 90 x 9

Hatch End Beam with Flange on Bottom 300 or Γ 270 x 90 x 14

Angle to Deck 75 x 75 x 15 x 15

Brackets at Hatch End Beam 1525 x 1525 x 13 with L 100 x 75 x 11 on the Edge

Hatch End Plating 10.5, Hatch Side Plating 11.5

8 Rivets in each Flange 22

Lower Deck

Deck Beams on every Frame Γ 220 x 75 x 12, Beam Brackets 840 x 840 x 15

Half Beams in Way of Hatches Γ 250 x 90 x 12, " 690 x 690 x 12

Stringer Plate 838 x 8

Stringer L 90 x 90 x 9

Hatch End Beam with Flange on Bottom 300 or Γ 270 x 90 x 14

Angle to Deck 75 x 75 x 15 x 15

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Hatch End Plating 10.5, Hatch Side Plating 11.5

8 Rivets in each Flange 22

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Stringer Plate 838 x 8

Stringer L 90 x 90 x 9

Hatch End Beam with Flange on Bottom 300 or Γ

Fig. 4.—Midship Section, M. S. *Tosca*

Length over all	114. 30 "
Beam, Molded	15. 620 "
Height of Upper Deck	2. 591 "
" Lower "	3. 050 "
" Promenade Deck	2. 600 "
" Fore/Aft Deck	2. 133 "
" Boat "	2. 362 "
" Bridge "	2. 600 "
" Upper Deck	0. 315 "
Camber	
No Camber in Tween Deck and Lower Deck	

Class+IAI with Freeboard N.V.
Veritas Numbers

Length Number L ($\frac{1}{2}B + D + \frac{1}{2}G$) = 34.96' 0"
 Width " ($\frac{1}{2}B + D + \frac{1}{2}G$) = 30.5"
 Topside " ($\frac{1}{2}B + D + \frac{1}{2}G$) = 47.44' 0"
 " L ($\frac{1}{10}(D+W)$)² = 2.591' M
 " = 14.925' M

H = Height of Shelter Deck
 $H/2$ = Half Circumference on Outside of Frames
 From Center of Keel To Under-Side of Upper Plate of Upper Deck =

Equipment

Equipment Number = $L \frac{1}{2} (B + D + \frac{1}{2} E) \frac{1}{2} H + 2 H L + 4443 \times \text{Bridge} = 4227$
 3 Stockless Bower Anchors, 2 of 3060 kg.
 1 Stream Anchor, Weight without Stock = 826 kg.
 = 356 kg
 1 Kedge " " " " 57.5 Diam.
 495 m. Chain of 165 m. Steel Hawser for Stream Anchor, 121 Circumference.
 220 m. " " " " 121 Circumf.
 2-163 m. " Hawsers, 70 " "
 2-163 m. " " " " 63 " "
 Chain, 1.5 " over N. V.

Riveting.

Butts:-

Upper Deck Stringer-Plate, $\frac{1}{2}$ L quadruple riveted, Ends double riveted, Rivets 22-19, sp. $3\frac{1}{2}$ " 0 for $\frac{1}{2}$ L, 4 D at Ends.

Tween " " " " triple "

Lower " " " " Single over Entire length; Rivets 16, sp. 4 D.

Fo'c's'le "

Remainder of Deck Plating, $\frac{1}{2}$ L double, Ends single; Rivets 19-16, sp. $3\frac{1}{2}$ -4 D. For Upper and Tween Deck, 4 D for Lower Deck.

Buffs of Side Plating and Double Bottom Rider Plate $\frac{1}{2}$ L triple riveted, Ends double. Rivets 19, spaced $3\frac{1}{2}$ D.

Remainder of Double Bottom Plating $\frac{1}{2}$ L double riveted, Ends single; Rivets 19, spaced $3\frac{1}{2}$ D.

Remainder of Double Bottom plating over entire length. Rivets 22-19, spaced $3\frac{1}{2}$ D.

Laps- Single Riveted 22-16 Rivets, spaced $4\frac{1}{2}$ "
Double Bottom Rider Plate - double, Riv. 19 ; spaced $3\frac{1}{2}$ "
Remainder of Double Bottom Plating - singleriveted, Rivets 19 ; spaced $3\frac{1}{2}$ "
Stool, Double Riveted over entire Length. Rivets 22-19 ; spaced $3\frac{1}{2}$ " 4 Dia

Plan View at Bilge showing
spacing of Gusset Plates
in Way of Lower Deck

Plan View at Bilge showing
spacing of Gusset Plates
where Lower Deck is omitted.

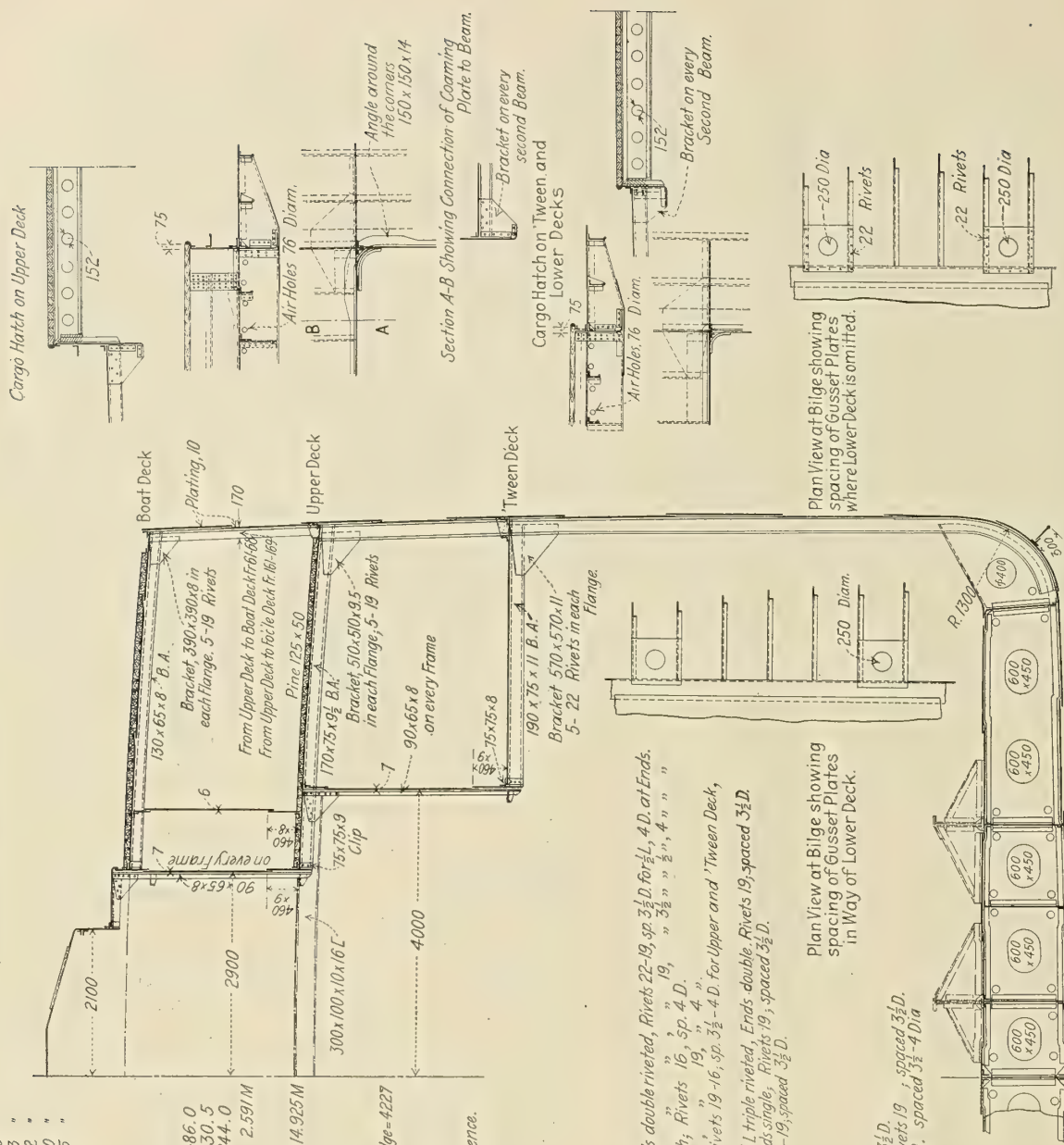


Fig. 5.—Section in Way of Machinery Space, M. S. Tosca

and piston cooling water pump; driven by a single electric motor.

An oil fired donkey boiler with a heating surface of 265 square feet.

CARGO HANDLING GEAR

The cargo is handled by eight 3-ton booms and two 5-ton booms, an additional boom of 25 tons capacity being located at hatch number 2.

DECK MACHINERY

Ten electric deck winches are provided for handling the leads from the cargo booms.

An electric driven windlass is located below the forecastle deck forward and is geared to drive two capstans located on the deck above.

A warping gear, which is also electrically operated, is

located on the upper deck just forward of the poop deck house.

The main steering gear is of the Hele-Shaw-Martineau electric hydraulic type. It is located in the poop and operated from the bridge by telemotor control.

A spare steering gear is provided on the poop deck. This is a hand operated gear and is direct connected to the rudder-head by a left and right worm transmission.

The motors for all deck machinery were furnished by the Electrotechnische Industrie of Messrs. Smit at Slikkerveer.

LIFEBOATS

Two lifeboats and two dinghies are located on the boat deck over the engineers' and officers' quarters and a motorboat is carried on the poop. All boats are handled by Welin davits and a spare set of davits is also provided, being located on the poop deck.

Ore and Oil Steamers Marore and Steelore

Two 20,500-ton deadweight combination ore and oil steamers are now under construction at the Sparrow's Point plant of the Bethlehem Shipbuilding Corporation, Ltd., for the Ore Steamship Corporation of New York city. The vessels are of the Bethlehem-Frear patent type and the cargo space is so arranged that a full load of either oil or ore can be carried in separate compartments. Oil will be transported from Tuxpan, Mexico, to Cruz Grande, Chile, whence ore will be carried to Sparrow's Point, Md. General cargo can be carried from Sparrow's Point to Mexico.

THE designs of the 20,500-ton combined ore and oil steamers now under construction by the Bethlehem Shipbuilding Corporation, Ltd., include a narrow elevated hold of great length and with sufficient capacity for a full deadweight cargo of iron ore. The space on each side and underneath the ore hold is divided into tanks 30 feet long which also have a combined capacity for a full deadweight liquid cargo. The effect of this combination is such that the center of gravity of both the ore and liquid cargoes is approximately at the same height as the center of gravity of general cargo properly stowed in a freighter of the ordinary type. This characteristic in combination with the relatively small sectional area of the ore hold extending over the greatest possible length of the vessel will have the tendency of reducing all stresses incident to carrying dense cargoes on an ocean voyage.

ORE AND OIL SPACES

The ore space, which is 14 feet above the base, is 30 feet wide and has a combined length of 360 feet. It is divided by watertight bulkheads into three compartments. Each of these compartments is served by three large hatches extending the full width of the ore hold.

The oil space, alongside and below the ore space, is divided by a longitudinal bulkhead extending from the keel to the ore hold. The foremost and aftermost compartments are for fuel oil and the tanks between these are for cargo oil. The oil spaces differ from the ordinary tanker in that there are no summer tanks. The wing spaces act as expansion trunks and, on account of their depth, afford the greatest possible flexibility for carrying liquid cargoes of varying density and adjusting the trim under all conditions of load. Each oil tank is served by an oiltight hatch, 80 inches by 39 inches, with 30-inch coaming.

GENERAL CARGO AND STORES

General cargo and stores are carried in the space just forward of the forward oil tank and in the 'tween deck space abaft the after oil tank. The forward general cargo space is served by 11-foot 6-inch by 9-foot cargo hatches.

The pump room is located between ore holds Nos. 1 and 2 below the ore hold, 30 feet long by 30 feet wide with a trunk 10 feet long by 30 feet wide extending to the weather deck. Under the pump room floor is a sump tank for draining ore holds Nos. 1 and 2. A sump tank is also fitted at the after end of No. 3 hold. The propelling machinery is arranged aft.

CONSTRUCTION

The vessels are built on the longitudinal system of framing with transverses spaced generally 10 feet apart. The ore hold side bulkheads are supported at every transverse by a wide transverse web and at each oil tank bulkhead by a fore and aft web. The span of the side transverses is shortened by the introduction of a transverse horizontal girder across to the ore hold between longitudinals 10 and 11. The depths of the transverses above this girder are varied with the increase in the depth of the vessel due to shear, being 36 inches where the depth is 44 feet and attaining a maximum of 42 inches where the depth is 47 feet 8 inches.

The framing of the bottom and side shell follows the usual practice for tankers.

The ore hold longitudinal bulkheads are sheathed with 2½-inch pine to above the height at which ore will be loaded. The floor of the ore hold, however, is not sheathed but is formed of ⅞-inch plating with sight edges of seams facing inboard so as not to catch the unloaded grab buckets.

The hatch covers to the ore holds are of the Hogg-Carr steel corrugated hinged type made of ¾-inch plating. The covers are of two parts, one-half hinging forward and the other hinging aft. Each cover is fastened down by fifty-eight 1½-inch dog bolts, and the joint between the two parts is drawn up tight by 1½-inch bolts.

CARGO HANDLING

The taking on of an oil cargo at Tuxpan, Mexico, presents a problem no different from that of the ordinary tanker. Three oil hose cranes and filling manifolds are located on each side of the upper deck and fill through 12-inch risers to the hold. For discharging oil, 10-inch suction in each tank

Ore and Oil Steamers Marore and Steelore

General Information

Service: Oil and iron ore, Tuxpan, Mexico, to Cruz Grande, Chile, to Sparrow's Point, Md.

Builder: Bethlehem Shipbuilding Corporation, Ltd., Sparrow's Point (Md.) plant.

Owner: Ore Steamship Corporation, New York City.

Characteristics

Length, overall.....571 feet 6 inches
Length, B. P.....550 feet 1 inch
Breadth, molded.....72 feet
Depth, molded.....44 feet
Draft, loaded, designed...32 feet 4 inches
Draft, light, estimated.....10 feet 9 inches
Block coefficient.....0.817
Midship section coefficient.....0.989
Longitudinal coefficient.....0.826
Speed, loaded trial, knots.....11½
Cruising radius, nautical miles
20,000 at 10.5 knots
Framing Longitudinal
Class...A-1 American Bureau of Shipping

Tonnages

(In tons of 2,240 pounds)

*Weight of hull.....8,150
**Weight of propelling machinery...950
Deadweight capacity.....20,500
Displacement.....29,600

(In tons of 100 cubic feet)

Gross register (calculated).....15,400
Net register (calculated).....9,479
*Weight of hull includes hull proper, hull fittings, equipment and outfit.
**Weight of propelling machinery includes engines, boilers (wet), shafting, propellers and machinery space auxiliaries.

Canal Ratings

(In tons of 100 cubic feet)

	Gross	Net
Suez	15,712	11,284
Panama (calculated).....	15,712	11,284

Equipment

Anchors:
2 bower, stockless, each.....14,105 lbs.
1 " " ".....12,005 "
1 stream, " ".....5,040 "
1 kedge, " ".....2,135 "
Chain cable, 330 fathoms, 2⅞" dia.
Stream chain, 105 fathoms, 1⅞" dia., or 5½" circ. steel wire.
Towline, 140 fathoms, 7" circ. steel wire.
Hawsers, 3 each 90 fathoms, 8½" circ. manila.
Warps, 3 each 90 fathoms, 7½" circ. manila.

Rudder

Area, abaft centerline of pintles.....244 square feet.
C. G. abaft centerline of pintles...4.66 feet
Diameter of stock.....15 inches

Complement

Deck officers	5
Deck crew	19
Engineer officers	7
Engineer crew	12
Stewards' department	10
Total officers and crew	53

Handling Equipment

	No.	Type	Capacity	Length
Masts	2	Pole		129 feet above deck
Derrick posts	10	Circular	3-ton	32 feet high
Booms	18	Oregon Pine	3-ton	36 feet

Deck Machinery

Steering gear.....16" by 12"-screw gear.
Windlass (1)...13" by 13"-triple spur gear.
Cargo winches (10).....8¼" by 10" compound geared.
(1).....9" by 12" compound geared.
Mooring winches (6).....10" by 12" special type.

Life Saving Equipment

	No.	Type	Length
Lifeboats	4	Bethlehem	26 feet
Work boat	1	Bethlehem	16 "
Life raft	1	Behlehem	25 persons

Propelling Machinery

Boilers

Number.....3
Type.....Single-ended Scotch
Length.....12 feet
Diameter.....17 feet 6 inches
Furnaces.....4 per boiler
Fuel.....Oil
Draft.....Howden system
Total heating surface, square feet...12,861
Total furnace volume.....2,226 cu. ft.
Superheat, degrees F.....600
Working pressure, lbs. per sq. in.....220
Normal fuel consumption:
Per day, tons.....43
Per horsepower hour, pounds.....0.9
Normal steam production:
Per hour per lb. of fuel, lbs., about 15
Total per hour, lbs.....54,000

Engines

Number.....2
Type....Curtis turbines, Falk single reduction gear.
Shaft horsepower, normal.....4,500
maximum.....5,000

Propellers

Number.....2
Type.....3-bladed, solid, machined
Weight.....16,000 lbs. each
Diameter.....15 feet 8 inches
Pitch.....12 feet 8 inches
R. P. M.....105
Projected area, square feet.....56.8
Developed area, square feet.....65.6

Auxiliary Machinery

Refrigerating Machinery

2 2-ton Brunswick ammonia direct expansion machines.

Engine Room

Condensers—2 main: total cooling surface 4,000 sq. ft.
1 aux: total cooling surface 1,000 sq. ft.

Evaporators—2 30 ton

Feed water heater—I multifold

Pumps

2 Main circ., 14" centri.; engine, 9" by 8" recip.
2 Main air, 9½" by 17" by 15" independent dual with augmentor jets.
1 Com. aux. air and circ., 12" by 14" by 14" by 12".

2 Main feed, 15½" by 11½" by 24" v. s.
4 Forced lubr. oil, 7" by 8" by 18" v. s.
1 Fire and general service, 10½" by 8" by 22" v. s.
1 Main bilge, 7" by 8" by 18" v. s.
1 Sanitary and 1 bilge, attached, each 6½" by 7½" inclined simplex.
1 Fresh water and 1 sanitary, each 4½" by 5" by 12" v. s.
2 Water circ. for lubr. oil, 9" by 10" by 21" v. s.
1 Grease extractor, 3" twin gravity flow.
1 Lubricating, oil cooler.

Boiler Rooms

1 Fuel oil transfer pump, 7" by 8" by 18" v. s.
2 Fuel oil service pumps, 7¼" by 5" by 10" h. d.
3 Fuel oil heaters.
1 Donkey boiler, Scotch, 1 furnace, 317 sq. ft. h. s.
1 Donkey boiler feed pump, 5" by 3½" by 6" v. s.
Forced draft blower....Howden, 90" fan, 2-8" by 16" vert. eng.

Forward Pump Room

2 Cargo oil pumps, 14" by 20" by 16½" by 24", compound h. d.
1 Ballast pump, centr., 100 h. p. turbine.
1 Transfer pump, 7" by 8" by 18" v. d.
1 Bilge pump, 7" by 8" by 18", v. s.

Electric Equipment

2 20-K. W., 115 volt, generators, G. E., driven by 9" by 7" vert. recip. eng.

Holds

No.	Length	Hatches
1 ore.....	120 0"	2 30'0" x 30'0" 1 19'0" x 30'0" 121,000 121,000
2 ore.....	130'0"	3 30'0" x 30'0" 1 25'0" x 30'0" 3 30'0" x 30'0"
3 ore.....	100'0"	2 30'0" x 30'0" 1 each 80" x 39"
1 to 11, oil.....	30'0"	

Capacities

Cargo Space

Compartment	Bales	Bulk
	Cu. Ft.	Cu. Ft.
No. 1 Ore hold	125,300	125,300
No. 2 Ore hold	106,500	106,500
No. 3 Ore hold		
Total ore space	352,800	352,800
For'd upper 'tween decks	15,547	16,477
" lower	22,222	23,228
Aft 'tween decks, port	5,102	5,694
" " " starboard	6,382	7,135
Total general cargo	49,253	52,534

Cargo Oil Tanks*

No.	Cu. Ft.	Gallons	Bbls.	Tons
No. 1	71,116	531,948	12,665	1,812
No. 2	70,350	526,218	12,529	1,793
No. 3	65,244	488,026	11,620	1,663
No. 4	60,290	450,970	10,737	1,536
No. 5	68,064	509,118	12,122	1,735
No. 6	67,748	506,756	12,066	1,726
No. 7	67,748	506,756	12,066	1,726
No. 8	67,748	506,756	12,066	1,726
No. 9	68,024	508,820	12,115	1,734
No.10	68,146	509,732	12,136	1,737
No.11	66,816	499,784	11,899	1,703
Total cargo oil	741,294	5,544,884	132,021	18,891

Fuel Oil Tanks*

Frs. 23-25	40,574	303,494	7,226	1,068
" 58-61	61,126	457,222	10,886	1,609
Deep tank	30,312	226,734	5,398	798

Total fuel oil .. 132,012 987,450 23,510 3,475
* Oil capacities given are net for both sides of ship, with no allowance for expansion.
1 cu. ft. = 7.48 gals.; 42 gals. = 1 barrel; 38 cu. ft. = 1 ton.

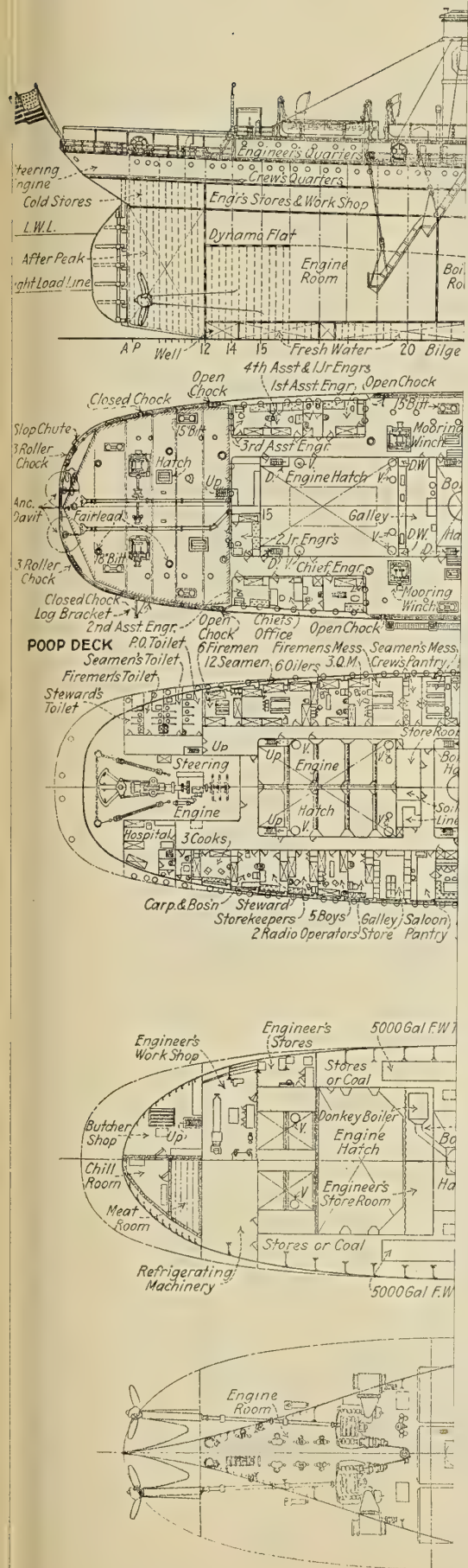
Refrigerated Space

Meat room.....1,418 cubic feet
Vegetable room.....1,245 cubic feet

Tanks

Compartment	Cu. Ft.	Tons
	F. W.	S. W.
Fore peak tank	23,170	662
Tanks on lower deck	1,336	37
Double bottom, 14¼-17	1,795	50
" " 17½-23-1/3	7,129	198
After peak tank	11,272	313
Total	44,702	598
		984

ORE AND



This technical drawing illustrates the deck layout of the USS Albatross (AG-39), a minesweeper. The drawing is divided into three main sections: the Upper Deck, Lower Deck, and a detailed view of the Forecastle Deck.

Upper Deck: This section shows the main deck area, including the Bridge, Observation Bridge, and Navigating Bridge. It also depicts various cargo holds (No. 1 to No. 11), fuel oil tanks, and other structural elements. The drawing includes labels for various rooms, tanks, and structural elements, along with a scale bar at the bottom.

Lower Deck: This section shows the deck area below the Upper Deck, including various cargo holds (No. 1 to No. 11), fuel oil tanks, and other structural elements. The drawing includes labels for various rooms, tanks, and structural elements, along with a scale bar at the bottom.

Forecastle Deck: This section shows the deck area at the bow of the ship, including various cargo holds (No. 1 to No. 11), fuel oil tanks, and other structural elements. The drawing includes labels for various rooms, tanks, and structural elements, along with a scale bar at the bottom.

The drawing is a detailed technical illustration, showing the layout of the ship's decks and various compartments. It includes labels for various rooms, tanks, and structural elements, along with a scale bar at the bottom.

TANK TOP

Fig. 1.—Profile and Deck Plans

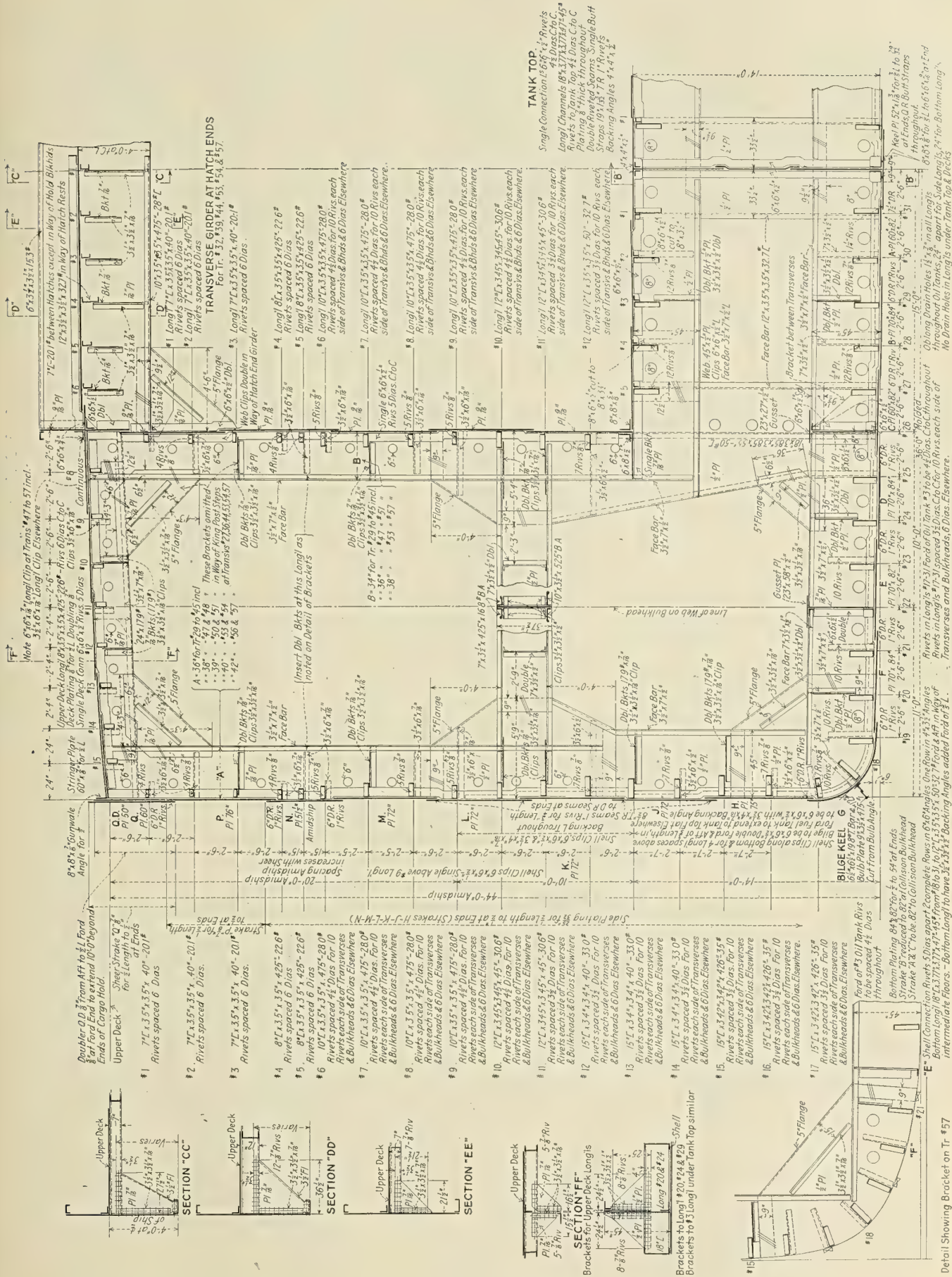


Fig. 2.—Midship Section, S. S. Marore and Steellore

Detail Showing Bracket on Tr. #57

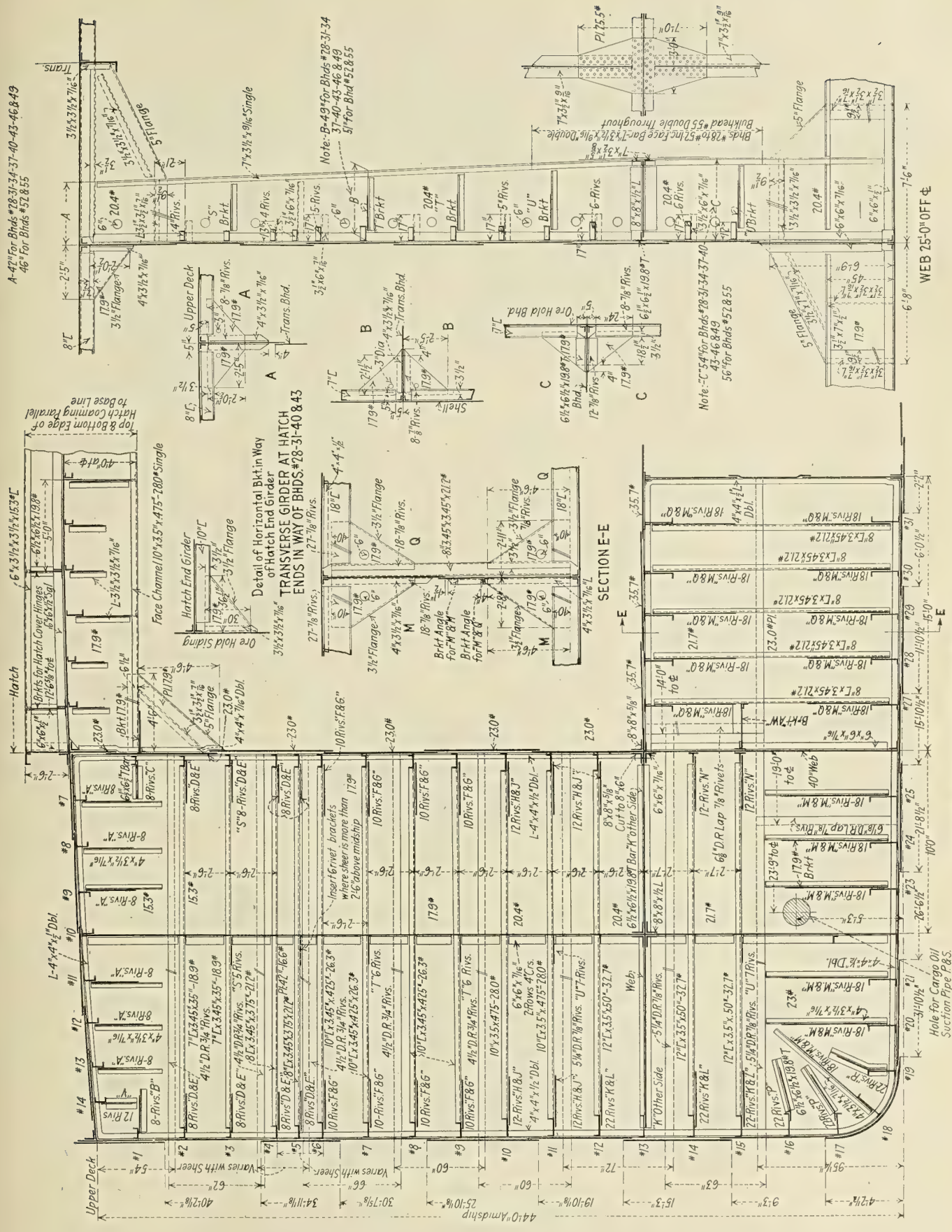


Fig. 4.—Oil-Tight Bulkhead, S. S. Marore and Steeltore

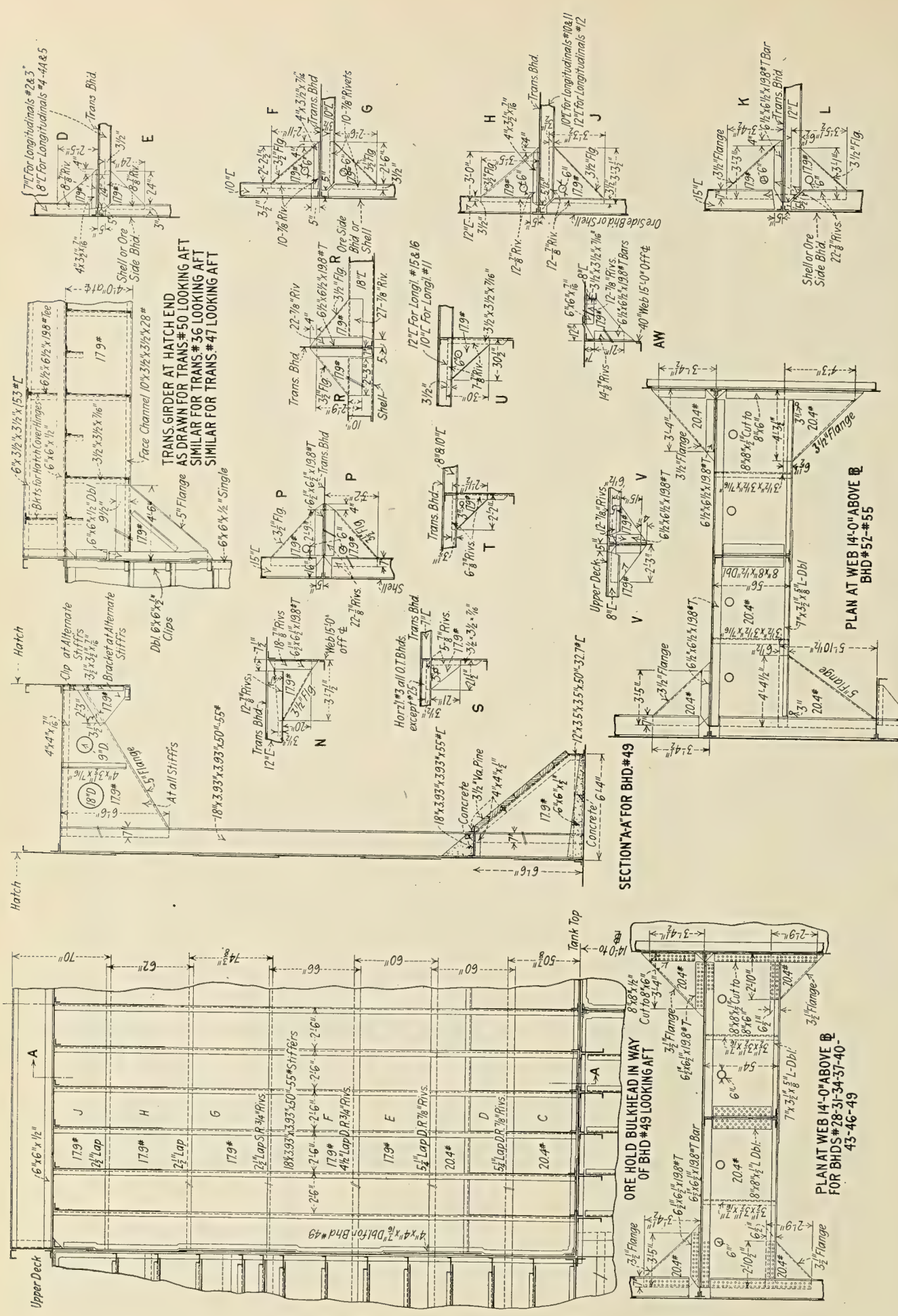


Fig. 5.—Oil-Tight Bulkhead Details, S. S. Marore and Steelore

discharge into the 14-inch fore and aft hold suction lines, one on each side of ship. The two horizontal duplex cargo pumps discharge through port and starboard 12-inch risers and through 12-inch discharge lines on the upper, boat and poop decks leading over the stern. Cargo and fuel oil tanks are provided with an efficient steam heating system.

Ore is loaded at Cruz Grande, Chile, after the oil cargo has been discharged. The discharging of ore at Sparrow's Point is done under two 15-ton grab bucket unloaders, and can be accomplished in about 40 hours. The area of the ore holds is so proportioned to the speed of the unloaders that the surface of the ore remains at a constant level relative to the unloaders as the ship loses draft due to the decreased weight.

Ten kingposts, with eighteen 36-foot Oregon pine booms of three tons capacity, are provided for the handling of cargo in the event of these ships becoming engaged in some other trade not having terminal facilities for loading and unloading. The ten 8¼-inch 10-inch winches which handle the tackle for opening the Hogg-Carr hatch covers are available for working the ¾-inch diameter wire rope whips on the cargo booms.

WARPING AND MOORING GEAR

The warping gear on these ships has been given very careful attention. The Bethlehem-Moore triple spur geared 13-inch by 13-inch windlass handles the 2⅞-inch anchor chain. Aft of this on the forecastle deck is a Bethlehem-Moore compound geared 9-inch by 12-inch winch with extension heads. On the upper deck forward, on the poop deck forward of the wing houses and again on this deck aft special mooring winches are fitted. These are of the Bethlehem-Moore 10-inch by 12-inch type and are intended for mooring to buoys at sea in a relatively fixed position, or two wharves while loading or unloading. In operation this type of winch automatically pays out the warping line when under excessive tension and establishes the necessary tension should the line become slack for any cause.

STEERING GEAR

The steering engine is of Bethlehem-Moore 18-inch by 12-inch screw gear type, with the three hand steering wheels located forward of the engine. The control is by the Bethlehem duplex ram hydraulic telemotor from the transmitter stand in the pilot house. The ship can also be steered by an emergency gear connected to the spring quadrant and operated by the mooring winches on the poop deck.

VENTILATION

The fireroom is ventilated by two 36-inch, and the engine room by four 30-inch diameter cowls, operated from below. The quarters are ventilated by 10-inch mushroom vents and the pump room by two 24-inch cowls. Fourteen 20-inch diameter ventilators with hinged tops are provided for the ore holds. The oil tanks are vented as follows: The forward deep tank by two, and the remaining fuel oil tanks by one each, 6-inch gooseneck vents. Cargo oil tanks Nos. 6, 7, 9 and 10 are vented through 3-inch pipes led up the nearest kingpost to about twenty feet above the deck. Tanks Nos. 3 and 4 have pipes led up the midship structure. Tanks Nos. 1, 2, 5, 8 and 11 are vented through the kingposts. Bethlehem standard 4-inch vapor valves are fitted to each vent pipe and at top of kingposts.

QUARTERS

Accommodations for deck officers are provided in a midship superstructure located over the pump room and supported on five transverse frames, the sides between the bridge and upper decks not being plated above the 42-inch height of the bulwark. The bridge deck, 10 feet above the upper deck, is plated and planked with 3½-inch Oregon pine.

The steel house on this deck contains the captain's office and purser's room and bath, the first, second and third officers'

staterooms, an officers' bath, the radio room and a medicine locker. It should be noted that no officers' dining saloon is located in the midship quarters. The observation bridge is decked with 3½-inch Oregon pine, and in the steel house are the captain's stateroom, sitting room and bath. The quarters on this deck and the bridge deck below are finished in white enamel with mahogany trim. The stateroom floors are covered with carpets and the bathroom floors with hexagonal tile.

On the upper deck aft, in way of the poop, are located the officers' dining saloon, crew's mess rooms, crew's quarters, hospital and steering engine room. The officers' dining saloon walls and ceiling are paneled in oak; the crew's mess room's and quarters are of cypress, finished bright. The upper deck, in way of the quarters aft, is planked with 3½-inch Oregon pine, as is also the poop deck, except at the extreme after end.

Quarters for the engineer officers are located on the poop deck, abreast the engine hatch. These quarters are finished similarly to those in the midship houses. The galley is also located on this deck between the engine and boiler hatches.

A complete steam heating system designed for 65 pounds working pressure is installed in all quarters.

The officers' and engineers' baths are provided with showers and heaters, having hot or cold salt water, and lavatories having cold fresh water. The crew's toilets aft have hot or cold salt water to showers and cold salt water to wash basins. Fresh water is carried in two 5,000-gallon tanks on the lower deck in the machinery space and in a 500-gallon gravity tank on the boat deck and in a 150-gallon gravity tank on the wheel house top. The plumbing fixtures are of good quality throughout.

PROPELLING MACHINERY

The vessels are propelled by two Curtis turbines with Falk single reduction gears manufactured at the Fore River plant of the Bethlehem Shipbuilding Corporation.

Steam is supplied by three Scotch boilers fitted with the Bethlehem-Dahl fuel oil burning system. Howden's system of forced draft is fitted. The boilers are being made at the corporation's Sparrow's Point plant and the oil burning system at the Redington plant.

AUXILIARIES

All of the auxiliary machinery is of the Bethlehem type with the exception of the refrigerating machinery, which is of the Brunswick type, the auxiliary air and circulating pump (Alberger), the grease extractor (Row and Davis), the lubricating oil cooler (Griscom-Russell No. 114 multiwhirl), the cargo oil pumps (National Transfer Company), the ballast pump (Dravo-Doyle with DeLaval turbine) and the generators (General Electric). Most of the pumps are manufactured at the Moore plant of the Bethlehem Corporation.

A donkey boiler is located on a flat between the engine and boiler rooms at the lower deck level. The engineers' store rooms and workshop are provided on this same deck on the port side, and the refrigerating machinery is located on the starboard side. At the extreme after end of this deck are the meat room, chill room and butcher shop.

The vessels described above are the Bethlehem hulls 4,212 and 4,213, named the *Marore* and *Steele*. Bethlehem hull, 4,210, building for the International Petroleum Company, is not yet named and hull 4,211 for the Ore Steamship Company is called the *Bethore*. These last two hulls are similar to those described above except that the main engines are triple expansion reciprocating with cylinders 25-inch, 41-inch and 68-inch diameter and a 48-inch stroke and that there is some difference in the arrangement of quarters aft. Bethlehem hulls 5,309 and 5,310, building at the Union plant of the Bethlehem Corporation at San Francisco, are called the *Chilore* and *Lebore*, and are similar to the *Marore* except that the hold space is designed to carry coal and ore instead of oil and ore. A description of the special construction adopted for this purpose will be given in a later issue.



Fig. 1.—White Star Third-Class Passenger Steamship *Vedic*

The Third-Class Carrier *Vedic*

White Star Line Adds Well-Equipped Liner for Third-Class Service Between New York and Liverpool

FROM a construction standpoint few vessels that have come out in the post-war period present more interesting points than the White Star Line's third-class carrier *Vedic*. This vessel was designed to meet a new condition in steerage traffic, namely, a demand for one-class ships. The tendency to abandon the steerage as such, has been marked since the end of the war. The leaven of democracy appears to have reached the transatlantic passenger trade with fully as much force as it has exerted in every country on the globe. The third-class traveler is no longer contented to be thrust into unsanitary quarters in the forepeak, or next to the rudder post, on a ship carrying first and second-class passengers in their best accommodation.

The result has been not only the improvement of third-class accommodation on the run of passenger vessels, but the construction of the third-class liner, so-called, of which the *Vedic* is an excellent example. This vessel, which was built by Harland & Wolff, Ltd., Belfast, Ireland, for the Oceanic Steam Navigation Company (The White Star Line), in the normal course of events would have gone into the passenger trade much earlier than she did. She came off the ways in 1914 and was immediately pressed into the service of the admiralty as a freighter and trooper, serving in these capacities throughout the war.

The ship was not at all known to the public when turned back to her owners in 1920 to be fitted up with passenger accommodation. Therefore, she came out early in 1921 virtually as a new ship, and on her first voyage to New York received considerable attention, being styled by her agents, "the ship of democracy." At that time, owing to a strike of British joiners, the ship's passenger quarters were not quite completed, but the work has since been finished, and the *Vedic* is now functioning fully on the run between New York and Liverpool, and is rendering very satisfactory service.

PRINCIPAL DIMENSIONS

A twin-screw vessel of 9,300 gross tons, the *Vedic* has the following dimensions:

Length overall.....	480 feet 7 inches
Breadth	58 feet 4 inches
Depth	34 feet

The ship's construction is rated A-1 in Lloyds. Her lines are pleasing and powerful, the distinguishing features being a cruiser stern, with white superstructure, a short forecastle head and a finely drawn, though powerfully flaring bow. She has one stack, placed almost directly amidships, and two masts with combination cargo derricks attached. She also has a very fine equipment of winches for the handling of

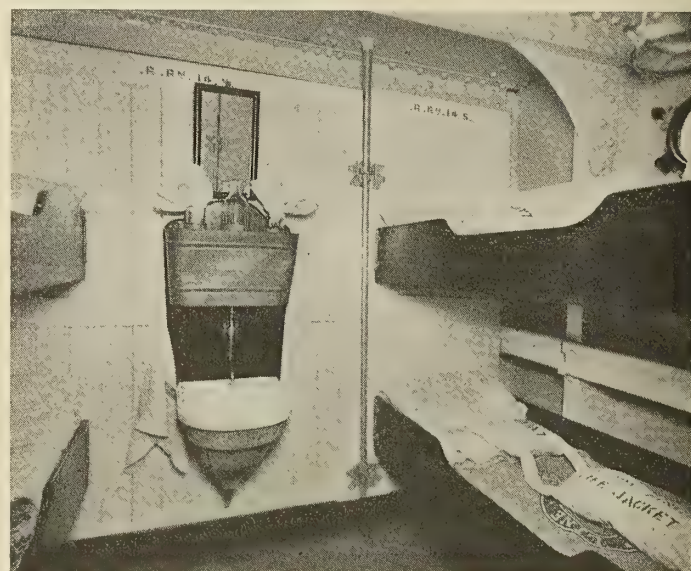


Fig. 2.—Four-Berth Stateroom

a large cargo. Her deck arrangements take into account, however, the need for promenading space for the passengers, and a proper balance has been struck between the space taken for equipment and that left for this purpose. As a matter of course, the vessel is equipped with boatage sufficient to take care of her total passenger complement and her crew, in case of necessity. Her sheer is graceful, and on the whole her appearance would do credit to a first-class liner.

SUBDIVISION

The ship's hull is divided by ten watertight bulkheads into



Fig. 3.- One of the Three Dining Saloons



Fig. 4.—Smoking Room

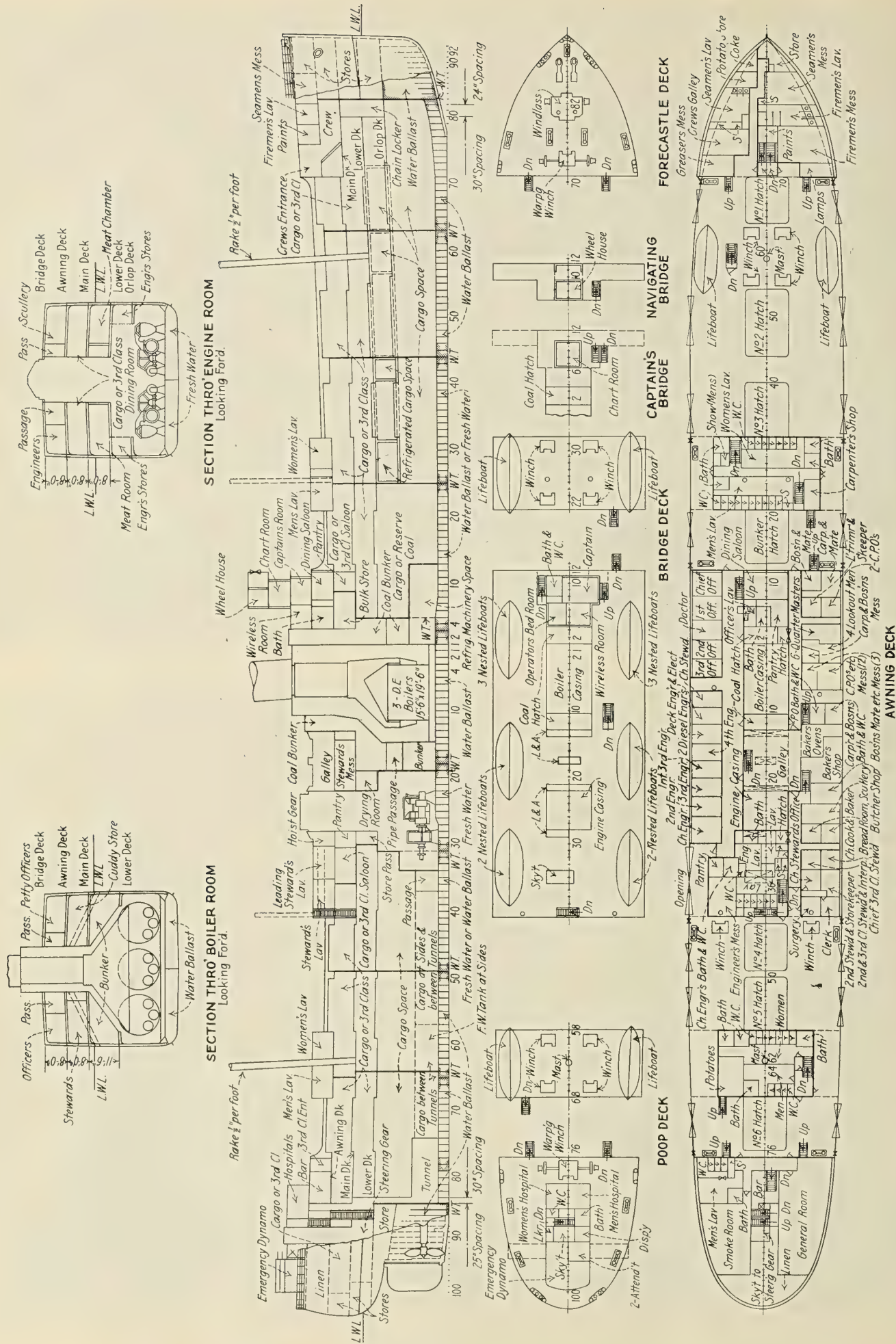


Fig. 5.—S. S. Vedic: Profile, Upper Deck Plans and Sections Through Machinery Space

eleven compartments, and her bottom has liberal tankage for water ballast or fresh water, the fore and aft peaks being reserved for water ballast.

PROPELLING MACHINERY

The ship's power plant is a model of its kind, with two sets of geared turbines, each set consisting of a high and low pressure turbine with a single reduction gear. There are three large double-ended boilers. Her coal consumption is said to be moderate, and her speed better than 10 knots with power in reserve.

ACCOMMODATION

In the arrangement of her accommodation for officers and crew, the ship is very attractive. The captain's room, together with the wireless room, is situated on the bridge deck and the officers' and engineers' accommodations together with their dining saloon are situated on the awning deck. The two principal dining saloons for passengers are on the main deck, the smoking room and the general room are on the awning deck, and one dining room is on the lower deck.

One distinguishing feature of all these apartments is the woodwork, which is done in paneled oak. Quite in keeping with the general character of the rooms is the furniture. One is scarcely accustomed to seeing swivel chairs and small serving tables in third-class, for example, yet this ship's smoking room has both, while there is a perfectly appointed bar where the third-class passenger may "wet his whistle" quite as satisfactorily as any first-class or second-class passenger on the ocean greyhounds.

STATEROOMS

The ship's passenger capacity is 1,200, and she has a crew of 208.

The most striking feature of her sleeping quarters is the small staterooms with two berths. There are also a considerable number of four-berth rooms, and some containing six berths, but the dormitory, so well known in earlier third-class carriers, in which large numbers of passengers were bunked in open spaces, has been entirely eliminated.

The walls and ceilings of the staterooms are in white enamel, and each room is furnished with a high grade vitreous china bowl, with nickled fittings and neatly designed metal water tank. Each room is fitted with electric light, sanitary floor covering and indirect ventilation. The berth boards are polished hardwood, and each bed is furnished with

a mattress, blanket, sanitary pillows with slips, and a bed spread on which is embroidered the house flag of the White Star Line.

STATEROOM WALLS REMOVABLE

One interesting feature in connection with the construction of these bedrooms is a system by which all the walls can quickly be taken down, as they are fitted in place by metal clamps interlocking with sockets on pipe stanchions.

The managers of the International Mercantile Marine Company of New York, of which the White Star Line is an important subsidiary, state that after four months of service the *Vedic* is rated as one of the most efficient vessels ever added to their fleet, which totals 106 vessels of more than 1,000,000 tons aggregate register.

Owing to her novelty, the *Vedic* has already attracted the attention of students of shipping. A magazine writer who recently crossed on her as a passenger, has this to say regarding the *Vedic's* accommodation, and the effect of the one class idea on passengers:

"The total absence of superior classes on board the *Vedic* is certainly not without its pleasant psychological effect. There is no one to look down curiously from a higher deck upon the strange denizens of the steerage, nor can first or second-class adventurers pass through the dining room to see "the animals feed." The ability to move about the ship produces a certain feeling of freedom not to be despised. In quantity and quality, the food has been quite as good as one could expect for the money. A chicken dinner we had on the two Sundays. Fresh fruit has been handed round at intervals.

"Capacious, comfortable and permanent social and smoking rooms occupy the entire stern portion of the *Vedic* on the main deck, garden-seating runs entirely around both and there are square tables with revolving chairs around them in each room. In the social room there is a piano. Both rooms have been kept clean and have been a distinct comfort to the passengers.

"One of the best things on the *Vedic* is the lavatory accommodation. Here in the past has been one of the great offenses of steerage travel. On the *Vedic* the lavatories are spacious, clean, light, well-painted, with tiled floors and due privacy. The wash basins are substantial affairs with running water and there is a bathroom supplied with hot and cold sea water. Mirrors are plentiful. In the cabin, stand wash-basins with individual supply tanks and waste basins are provided, also water bottle, glass and mirror."

The Availability of the Ex-German Ships

BY WILSON P. SMITH

The availability of the ex-German passenger ships for use in the American Merchant Marine is a timely topic at this particular period. With the Shipping Board's policy of allocating certain of these vessels to different operating companies, reconditioning is necessary to restore the ships to a suitable condition for competition with passenger liners of other nations. A close study of the German ships reveals a number of items of interest, a few of which are enumerated.

THE reported excessive reconditioning costs of the ex-German liners can be better understood after a careful study of the great amount of work necessary to restore these vessels. When they were interned and made ready for war service as troop transports, their interiors were, to a more or less extent, entirely cleaned out. It seems to have been the policy of the Government at the time to leave the public rooms and the upper deck first-class staterooms for officers'

use. Invariably, the lower decks containing second and third cabin rooms were completely stripped, and the compartments used for open standee berthing of troops.

A very important item in the conversion of these ships into passenger liners is their speed. This must be reckoned with in determining the class of passengers desired to be carried. These ships vary in speed from 11 to 26 knots, and in age from 6 to 26 years. Prior to 1901, the fastest of these ships

was the *Aeolus*, ex-*Grosser Kurfurst*, designed for 15 knots. Following this came the greyhound type with varying speeds up to 23 knots. Included in this group are the *Von Steuben*, ex-*Kronprinz Wilhelm*, and the *Agamemnon*, ex-*Kaiser Wilhelm II*. The *Leviathan*, ex-*Vaterland*, was the latest development at 26.3 knots. These items must be gone into carefully by the ship operator before the reconditioning plans are worked out.

Structurally, the German ships are well built—the material appearing, when the sheathing is removed, in a wonderfully well preserved condition. Their type of construction differs materially from shipyard practice in America; their shapes are quite different, and their manner of securing continuity of strength far different from those employed in this country. Ridge bars are almost entirely lacking, and stanchions are placed directly on a steel deck, attaching to the deck beam overhead, no attempt apparently being made to register stanchions deck over deck.

The deck machinery is good, and usually massive. A number of very ingenious arrangements are employed, particularly in the detail of miscellaneous fittings.

ELECTRIC WIRING OUT OF DATE

The electric wiring is entirely out of date, and in reconditioning a ship for passenger use it must be entirely rewired. Their single wire system—using the shell as a ground—together with their generators, which are invariably shunt wound and not parallel, offers a wholly impracticable proposition to retain as originally installed. The method of carrying the wiring throughout the ship is extremely bad, no effort whatever having been made properly to insulate it in passing over and through woodwork. As installed, it would be practically impossible to secure the necessary certificate of approval on this work.

The joiner work has been given most careful attention. In many instances it is a marvel in craftsmanship. The bulkheads generally are of panel construction with ventilating transoms along inboard bulkheads; doors with "V" louvres fitted in the lower panel are the best that can be desired for their particular purpose.

DECORATIONS FAR FROM PLEASING

In the attempt to decorate, the good impression of the joiner work, in many instances, was lost. At craftsmanship, the Germans are past masters, but as decorators the results are far from pleasing. Invariably some incongruous and meaningless plastic work is spread out promiscuously in panels, which would far better be left plain. In the interior design of their ships, the Germans were correct and appealing, probably, to the traveling public of their day. To the present day traveling public, they would receive only adverse criticism. The deck heights were low, and spacious rooms suffered from this lack of height. Bathing facilities were exceedingly limited and the use of folding wash cabinets general to a great extent.

In reconverting these ships to cater to the tastes of the cultivated American traveling public of today, very little of the stateroom arrangement existing can be utilized. This has been shown conclusively in the ships reconditioned up to this time—the *Huron*, *Callao* and *Aeolus*, for example. The public of today demands greater bathing facilities and numerous private baths, in addition to running water in all staterooms.

PLUMBING UNSANITARY AND FAULTY

The plumbing on the German ships is probably the most offensive feature of all. The fixtures are not sanitary and are of poor design, the material in most cases being excellent. With the continental idea of bathing necessitating a full length tub, those fitted on the German ships, to an American, seem preposterous. By actual measurement it has been shown that the German tub requires exactly twice the quan-

tity of water required by an approved American tub. The lavatories in the better ships are a very excellent grade glass fixture, but unsatisfactory from a sanitary standpoint, in that they are in three pieces and not integral.

The furniture available from these ships is of the highest order, though some very crude designs appear among them. With minor reconditioning and new upholstering, a large percentage of furniture can be salvaged. The German springs for berths were another of their ingenious fittings, and are today unsurpassed for comfort at sea.

In floor tiling, the Germans have produced and laid in an excellent way a very high grade of floor covering, in many instances original tiling remaining in first-class condition after 8 or 10 years' hard use.

SERVICE ARRANGEMENTS WELL PLANNED

The service departments were highly developed and their galleys, pantries and bars were exponents of the very best for the quick and constant service demanded on liners.

The main engines and auxiliaries varied in type with the age of the ship, and are usually found to be quite efficient though rather heavy and crude in design. Cold storage compartments on the larger ships were excellently constructed, but as the grade of the ship was lessened, so was the completeness of this important section of the ship's service curtailed.

AMERICAN VS. GERMAN PASSENGER REQUIREMENTS

American practice and regulations of today differ widely from the German of the period when these vessels were designed. The American ship must give more superficial feet to third-class passengers, with a consequent reduction of passengers of this class carried. The loss is nearly 20 percent, with a corresponding falling off in revenue. American ships must carry a much larger crew, and berth them with more deck area per man. This must necessarily invade the original passenger sections and again reduce the already lessened passenger list. From this it can easily be seen that the criticism of reconditioning at excessive cost for an actual loss of passengers is not all the fault of the re-designing architects, but is caused by regulations to which they must adhere in allocating space.

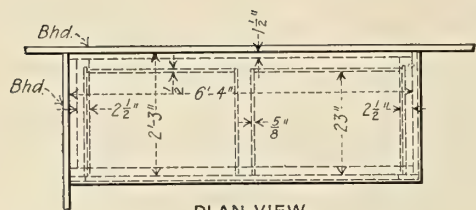
Taking all in all, the ex-German ship is not readily adaptable to an American express liner use, because of the many features lacking in her design which must be supplied to create an acceptable ship. The companies to which these vessels are allocated must spend an apparently large amount of money in restoring the ships to the use for which they are desired, involving expenditures which it is difficult for the landsman to understand.

Magnesite Composition Decking on Combination Passenger and Cargo Vessels

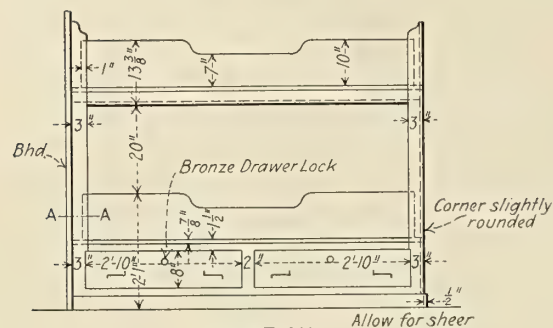
IN the description of the *Hawkeye State* published in the March issue of MARINE ENGINEERING the subject of deck covering, a very important item on passenger ships, was overlooked. Two of the five passenger ships built and building at the Sparrows Point yard of the Bethlehem Shipbuilding Company have had their decks, with the exception of the dining rooms and passageways, covered with Litosilo manufactured by the Marine Decking & Supply Company, Philadelphia, Pa. On the three remaining ships Litosilo will be used throughout. On nine of the passenger vessels built and building at the New York Shipbuilding Corporation, with the exception of the first ship, on which cement was laid in the passageways, Litosilo is used throughout. The same is true of two combination passenger and cargo vessels building at the Newport News Shipbuilding & Dry Dock Company. In the passageways and public spaces of the ship Litosilo is usually covered with a composition or rubber tile and in staterooms it may be partly covered with rugs.

Ship Joiner Plans

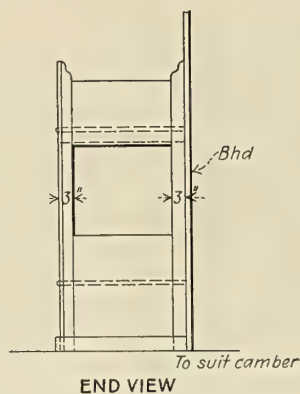
Built-in Berths



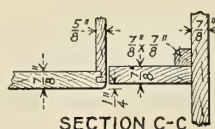
PLAN VIEW



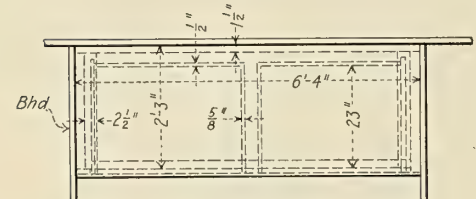
ELEVATION
TYPE A
One End Open



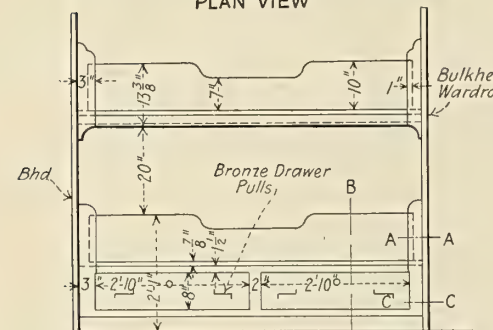
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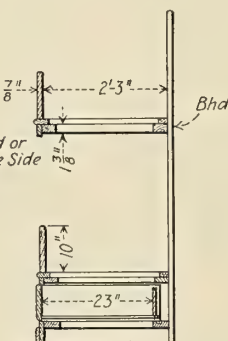
SECTION C-C



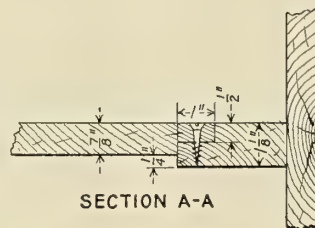
PLAN VIEW



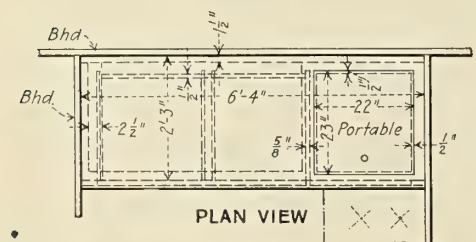
ELEVATION
TYPE B
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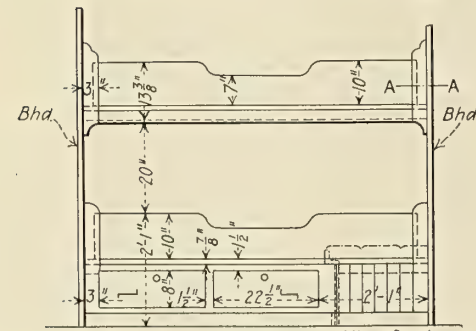
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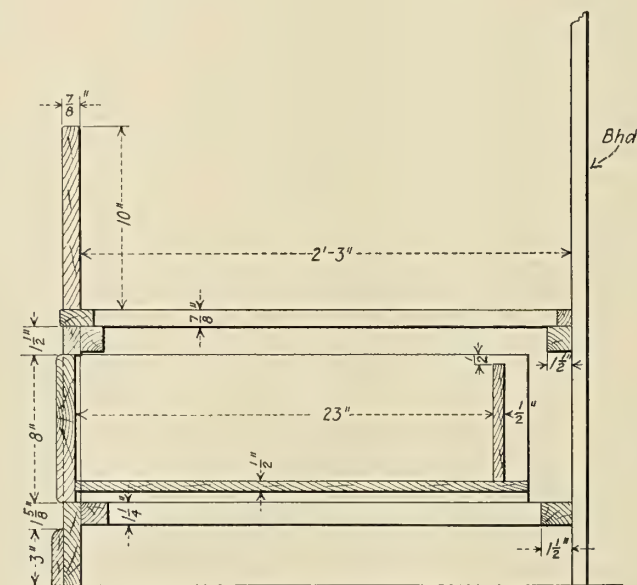
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PLAN VIEW

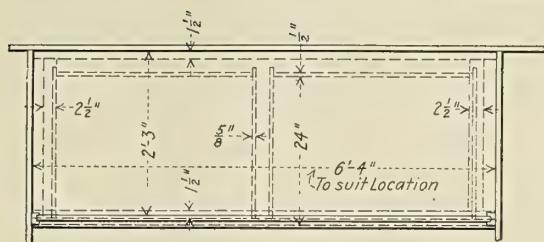


ELEVATION
TYPE C
With Transom

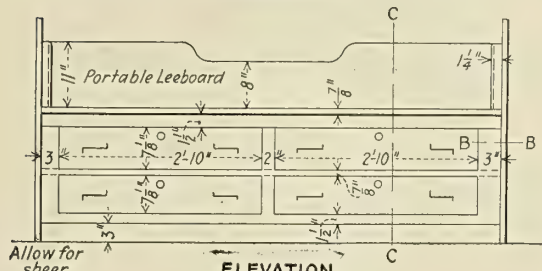


SECTION B-B

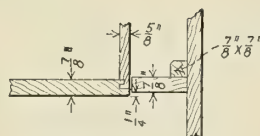
Built-in Berths



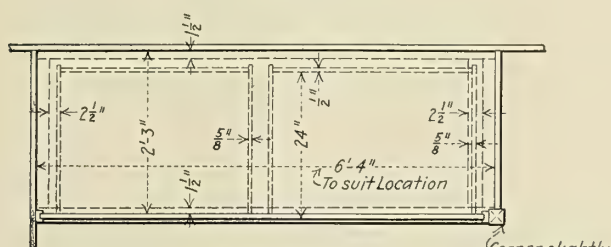
PLAN VIEW



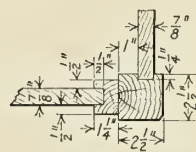
ELEVATION
TYPE D
Both Ends Closed By
Bhd. or Wardrobe.



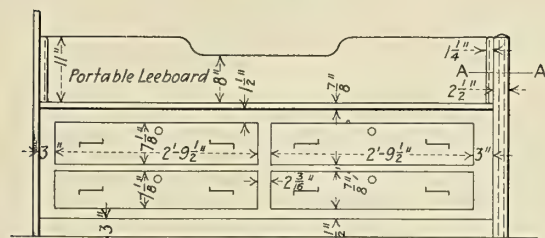
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PLAN VIEW

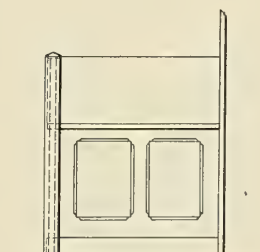


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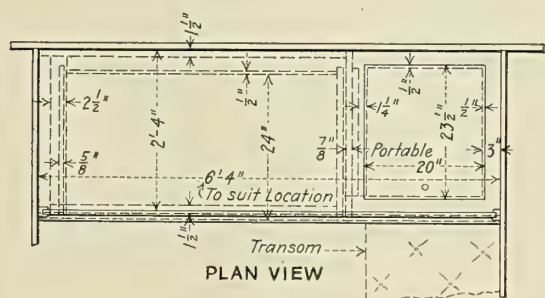


Allow for sheer

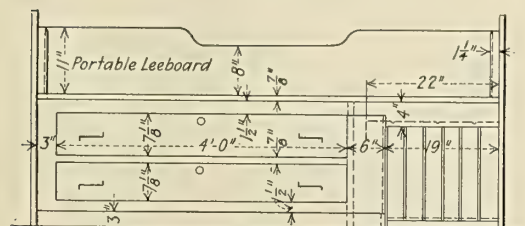
ELEVATION
TYPE E
One End of Berth Open



END VIEW

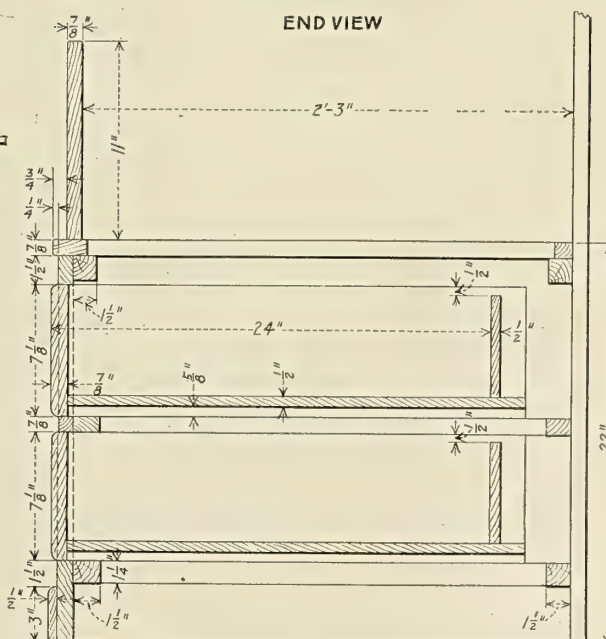


PLAN VIEW



Allow for sheer

ELEVATION
TYPE F
Both Ends Closed By Bhds.
and Transom Fitted.



SECTION C-C

Heavy Claims Against the Government Held by Shipbuilders and Shipping Interests

BY WALDON FAWCETT

Not the least of the responsibilities facing the new executive administration at Washington and the new Congress of the United States is that involved in the adjustment and settlement of the claims of shipping and shipbuilding interests. Irrespective of what policy may be worked out for the future operation of the government's merchant fleet, and irrespective likewise of whether the present Shipping Board organization shall survive or be supplanted by a new managerial agency, there looms the obligation to dispose of a formidable aggregate of claims that have grown out of the construction and operation of the war-inspired merchant fleet.

AMONG some persons in maritime circles, as well as outside, there has been an impression that the only obligations in this quarter on which Uncle Sam has been *slow pay* are the claims of the wooden shipbuilders. This estimate of the situation falls short of the facts. Tardiness in making final payments to the wooden shipbuilders has stirred feelings of sympathy, to be sure, partly, no doubt, because many of the claimants are operators of comparatively limited resources who are inconvenienced by the delay. But in terms of dollars, the aggregate of the claims of the wooden shipbuilders is overshadowed by the sum of other claims that remain to be disposed of, ere the governmental shipping enterprise may be said to have attained a definite or permanent status.

According to the latest information available to the General Comptroller of the Shipping Board and his assistants there are on record or "on the way" claims aggregating about \$147,000,000. This total includes the claims for just compensation for ships requisitioned during the war. The officials figure that they will require \$25,000,000 to pay the claims that are due, as it were, before the close of the present fiscal year on June 30, 1921, and that not less than \$25,000,000 will be needed for the payments to be met during the twelve months beginning July 1, 1921.

CLAIMS FOR REQUISITIONED SHIPS

Particularly significant, in the immediate situation, is the factor supplied by the claims for requisitioned ships which foot up \$45,189,000. On the part of the officials of the Shipping Board, Emergency Fleet Corporation there is a disposition to, sentimentally, regard these claims as settled because definite awards have been made. But the awards, save in a small proportion of cases, have not been accepted by the claimants, which circumstance reveals the element of dispute or controversy that must be reckoned with in considering the situation as to claims and that will probably result in legal contests that are likely to drag their weary course through the Federal courts for years to come—a heritage of the war similar to that which came, it will be recalled, from the Spanish-American war.

The situation with respect to compensation for the former owners of requisitioned ships may best be indicated, perhaps, by stating that the awards made against the aggregate of \$45,000,000 in claims aggregate to date \$16,434,000. Payment has been made to the amount of only \$2,459,000, leaving more than \$13,000,000 of approved payments yet to be made. Inasmuch as the claimants have not accepted the awards represented by the amount last mentioned it is, of course, impossible to declare even this portion of the transaction a closed incident.

UNCERTAIN STATUS OF CLAIMS

Chaotic is too strong a term to apply to the situation with respect to shipping and shipbuilding claims but certainly the

current status is one of pronounced uncertainty. To begin with, there is the circumstance that different kinds of claims—cancellation claims, contract claims, etc.—are so interwoven that detailed appraisal is almost impossible. Added to that is the impossibility of figuring on any hard and fast rules or percentages for settlements. Commenting recently to the effect that a claim for, say, \$6,000,000 was likely to be settled ultimately for \$1,000,000, Commander Gatewood remarked that it was impossible for any persons to estimate into what terms of cash payment the \$147,000,000 in listed claims will ultimately be translated.

The more of conjecture and less of substance there is at this stage comes from the fact that by no means are all the claims yet in. The General Comptroller said the other day that he knew of \$31,000,000 in claims that have not as yet so much as been placed on file. The claims of the shipbuilders in particular are incomplete. The attitude of the Shipping Board officials is that the shipbuilders, generally speaking, have built up their cancellation claims as high as they can and that on general principles these amounts must be reduced before settlement can be sanctioned.

EXTENT OF GOVERNMENT LIABILITY

During the past few months there has been considerable discussion and some difference of opinion as to the extent to which the liability of the government was fixed in the cancellation of shipbuilding contracts where work had been commenced or material purchased. Such contracts were, following the signing of the armistice, summarily canceled by wire and then confirmed by letter. The contractor was then expected to put in his claim for the amount of money already expended for labor and material and to cover commitments. The occasion for negotiation with respect to these shipbuilding claims has been found not so much in tangible items of ascertainable proportions as in the claims for sacrifice of less obvious dimensions such as the loss of anticipated profits and the disruption of plant routine due to the sudden termination of the contract. The Shipping Board is unwilling under any circumstances, it might be added, to allow claims for *anticipated profits* but the mere presence of such items in claims operates to render tedious the process of adjustment.

COMPLETION OF GOVERNMENT VESSELS

A very interesting side-light was thrown recently upon the situation with respect to shipbuilding claims when the committee on appropriations of the House of Representatives considered the feasibility of practicing economy by delaying the completion of new vessels, building on the cost-plus basis, through the simple process of withholding appropriations. Director of Construction Gatewood opposed this policy as calculated to bring down upon the head of Uncle Sam a considerable addition to the already heavy load of shipbuilding claims.

The head of the construction department told the Congressional committee that if anything was done to interrupt the normal progress of the building program, on either the cost-plus or lump-sum basis, the sequel would be found in the submission of additional claims for damages. He ventured the opinion that a shipbuilder whose operations were interrupted by the government "would have a good claim." The chairman of the Congressional committee thought that the limit of a shipbuilder's claim under such circumstances would be a sum equivalent to 6 percent interest on the invested money tied up but Commander Gatewood disabused his mind with the explanation that with a ship under construction, just as with a building half completed, sudden stoppage of work would warrant a heavy claim for damages because of the overhead involved, the disruption of the organization, etc., etc.

REINSTATED CONTRACTS

Shipping Board officials have, in this same connection, strongly dissuaded an element in Congress that would fain reopen the subject of the vessel construction contracts that are now being carried out in lieu of cancellations. Practically every vessel now under construction for the Shipping Board represents a new transaction in lieu of a cancellation—a ship *reinstated* to agree with a claim already adjusted with the shipbuilder or contractor. To illustrate the situation it may be related that one shipbuilding concern said: "If you will give us three ships out of the ten you originally promised us, we will settle for so much." That attitude has been the attitude of a majority of shipbuilders, with the result that a great number of compensating contracts are now under way.

Some Congressmen, who feel that the government would have saved money if it had canceled all contracts and made the best settlement it could, have in deliberations over future appropriations been flirting with the idea of curtailing obligations in this quarter. Commander Gatewood has served warning that, if the settlements or compromises made are opened up, the action will bring in its train a new crop of claims in addition to the claims that would grow out of the stoppage of work. The contention of the Shipping Board executives is that the commitments for materials were so heavy in the case of the average group of vessels affected by compromise that it was obviously the part of wisdom for the government to follow through with a curtailed construction program in order to get its money back rather than to make a settlement that would involve the complete abandonment of the material on hand.

PAYMENT OF CLAIMS

Not only is the adjustment of claims proceeding with deliberation but the actual payment of claims—even in the instances where shipbuilders or vessel owners are prompt in acceptance of propositions made to them—do not keep pace with awards. This is due to the fact that there is involved a considerable amount of detail that cannot be denounced as mere "red tape." For example, after the claims board has passed upon a claim award there remains the necessity of ascertaining what advances have actually been made to the contractors. This last constitutes, indeed, a phase of Shipping Board operations the magnitude of which is not fully appreciated even within the industry. The long time loans made to shipbuilders by the Shipping Board and covered by mortgages running from 1921 to 1930 amount to more than \$21,000,000.

The machinery for the adjustment and settlement of claims against the Shipping Board is contained in the Claims Board, which is of comparatively recent origin and which is made up of four members, some of them qualified by long connection with the Shipping Board whereas others have had practical experience in private shipbuilding. The operation of the Claims Board entails an expense of about \$200,000 a year and presumably will not continue for more than a couple of

years or so, inasmuch as claims that cannot be disposed of by this agency within a reasonable time will undoubtedly go to the Court of Claims.

PROCEDURE OF CLAIMS BOARD

The simple procedure is for the Claims Board, after the requisite survey and first-hand negotiations with the shipbuilder or contractor involved, to pass a resolution settling the specified claim by award of a fixed sum of money. However, considerations other than cash are apt to enter into the settlement of a claim. Notably there is the question of salvage. Instead of taking over all of the accumulated materials or salvage, the Shipping Board frequently offsets a claim by turning over the materials to the contractor in part settlement of his claim. To determine the loss sustained and the allowances to be made under such circumstances it is necessary, of course, to compute the cost price of hundreds or perhaps thousands of material items. In due process the Claims Board passes a resolution reciting that the stipulated claim is settled for a certain cash payment, plus the material in the shipyard which represents expenditure in an acknowledged sum. In that form the award goes to the General Comptroller.

ANTICIPATED PROFITS

In order to emphasize a point that seems to have been the subject of misunderstanding in shipbuilding circles it may be reiterated that it is not the policy of the Claims Board to make any allowance in settling a claim for prospective or anticipated profit. A reasonable profit is, however, presumed to be conceded on the work done by a shipbuilder or other contractor up to the time of the cancellation of the contract. Where material has been purchased, as has been the case in virtually all contracts that are subject to adjustment, it is customary for the Claims Board to allow a handling charge that is understood to run about 6 percent, on the average. Naturally, however, there can be no uniform allowance for this service inasmuch as there is variation—in the cases of different shipbuilders in the work and expense involved in the delivery, storage and insurance of accumulated material.

The estimates of claims in the shipping and shipbuilding undertaking that have been supplied to Congress in the spring of 1921 do not attempt to make calculation of the amount of money that will be required for the wooden ship amortization. The issue of the claims of the wooden shipbuilders was first taken up by Congress more than a year ago but there persists a sharp division of opinion as to the amount of responsibility involved. Officials of the Shipping Board have all along contended that there is nothing in the records that officially commits the Shipping Board or the Emergency Fleet Corporation to obligations through the equipment of shipyards or the construction of vessels other than those fixed in the contracts entered into.

THREE TYPES OF CLAIMS

Tersely, then, the attitude at the Shipping Board is that all the claims of the wooden shipbuilders divide themselves into three classes. In the first class are the claims for compensation for work performed and material furnished. In the second class are the claims for legal damages growing out of contracts that were canceled—claims on a par, that is to say, with most of the claims in the steel shipbuilding field as above discussed. In the case of both these classes of claims there is, as it is represented, no difficulty except that of agreeing upon the amount to be allowed in each individual case. The third class of claims, however, is of a character that involves the controversial element. They are based upon assurances which wooden shipbuilders say they received from representatives of the Shipping Board but which took the form of oral promises or other informal commitments rather than contracts duly signed and sealed. All the wooden shipbuilders who have claims of this type feel that they were as-

sured a much larger volume of work than they received from the Shipping Board. Some of the builders had the distinct impression, as the result of their negotiations with representatives of the government, that they were to have at least three turns of the ways.

LUMP SUM TO COST-PLUS BASIS

Most of the contracts held by wooden shipbuilders were originally lump-sum contracts—that is contracts that, in each instance, fixed a definite sum for a definite amount of work. It was ascertained as the shipbuilding program progressed, however, that the amounts that had been fixed were, in many instances, too small. There were delays also in getting materials and the changes made in the plans of the ships likewise counseled some more equitable basis of compensation. Consequently the Shipping Board in a number of instances, where application was made, changed the contracts from a lump-sum to a cost-plus basis, but in most instances fixed a definite fee to be paid for profit and amortization. The payment of those fees, calculated on the amount of work actually performed has, in no instance, however, proved sufficient to even approximately amortize the cost of the shipyard or to make the shipbuilder whole. In the field of wooden ship construction, in contrast to the steel shipbuilding situation, the basic question at issue has been whether the government should amortize the shipyards.

NORWEGIAN SHIP CLAIMS

An interesting phase of the claims situation has to do with the Norwegian ship claims, passing mention of which was made in the report submitted in March by Chairman Walsh of the select committee of the House of Representatives on Shipping Board operations. The investigating committee notes the division of opinion among persons who considered the claims of the several Norwegian owners, known as the *stray* group whose vessels were requisitioned under authority of the President. Involved in this aspect of the claims situation are five principles as follows: (1) that the vessels on the stocks and materials for their building were taken and not the contracts; (2) that the contracts were taken over as well as the vessels on the stocks and the material for their building; (3) that a treaty was violated in the taking of either the physical property or the contracts; (4) that the treaty was not violated in that an act of Congress signed by the President abrogated the treaty; (5) that the assignability of the contracts is involved as to the rights of persons who purchased from the original owner under the terms of the building contract. The award made to the *stray* group was \$34,500,000 and the Congressional committee expresses no opinion as to the merits of the claims and the settlements, because the settlement of similar claims has been taken up with the State Department in a request for arbitration.

Catch the Bees

Consider the B. T. U.'s and How They Escape! A Chance to Cut Down Fuel Bills and Keep Up Wages

BY "OLD SCOTCH"

THE ordinary, garden and field type of bee is the symbol of work, due to his indefatigable habits of industry when the sun is shining, and his forehandedness in laying by his food for the period when, due to climatic conditions, he can no longer work at his chosen job of extracting saccharine matter from clover and other flowering plants. Hence there are many qualifications of the bee which can well be emulated by mankind and especially that portion of the race which goes down to the sea in ships.

There are bees by the millions on shipboard, and it is the training of these and their proper utilization which form or should form the principal occupation of marine engineers. The bees I have reference to are not those of the gaudy wings and the merry buzz, but as workers they have the honey gatherers backed off the map.

THE MARINE BEES

This marine type however, unlike their cousins on land, are not so tractable and instead of following their leaders and driving along in swarms, they have a faculty of breaking away from the procession at every turn in the road and dissipating their energy in useless endeavors. Those of you who have heard Frank Bacon in "Lightnin'" tell of how he was the first man ever to drive a swarm of bees across the plains can well appreciate how much more difficult it would have been for that dear old prevaricator to have driven a swarm of these marine bees when I tell you that the bees I have reference to are the B. T. U.'s liberated in the furnaces of the ships' boilers due to the union of the carbon in the coal or fuel oil and the oxygen in the atmosphere. As soon as these bees are formed they immediately try to make their escape in the paths easiest for them to make their getaway. Holding them together and making them work is the task set for the firemen and engineers.

There are 14,000 of these little workers in every pound of good coal, and over 19,000 in every pound of good oil: in these days of high fuel costs every B. T. U. possible should be caught and made to do some good, honest work. We all know, of course, that in spite of precautions some eighty or ninety percent of them get away without doing anything worth while, so there is a very large field in which engineers can operate in this game of bee catching.

THE BEES THAT ESCAPE

Assuming that the engineer's crew on a merchant cargo vessel receives fifty percent of the total money paid for wages and overtime, the figures recently given out by the Shipping Board as to the relative costs of different essentials of ship operation will show that the average cost of fuel is just about seven times the cost of labor for the engineer's force.

As fuel is such a large portion of the cost of operation, and as the efficiency of the engineer determines to a great extent the amount of fuel used, it can readily be seen how important it is to the shipowner and to the entire merchant marine that every means be taken to improve the efficiency of the men who hold such responsible positions on the ships.

CHANCES FOR SAVINGS ON BOARD SHIP

It cannot be said even by the most radical labor advocate that American marine engineers are not well paid at the present scale of wages. The tendency of the period of deflation upon which we are now well advanced is for a general reduction of wages in all branches of industry. Already this reduction has struck the shipyards to the tune of from ten to fifteen percent, notwithstanding the fact that the efficiency of the average shipyard mechanic has vastly increased within the past two years following the Armistice.

The opportunity for increased efficiency on shore is not

comparable with the chance for savings on board ship. If marine engineers and firemen wish to stave off what appears to be an inevitable reduction in their wages, they must immediately take steps to improve their efficiency. A 10 percent saving in the amount of fuel consumed and at least fifty percent reduction in the cost of repairs are well within the possibilities, and a quick demonstration of such ability ought to do much in influencing the average steamship owner and operator to defer wage reductions.

Engineers quite generally admit that they cannot much longer insist on being paid for overtime. They may as well realize that they will have to begin at once to return to old-time conditions of doing many of their own repairs. The proverbial "stitch in time" is very applicable to marine engineering, as the fitting of a new stud, the stopping of the smallest leaks oftentimes forestall the necessity for extensive repairs when the ship reaches port. The owners can help out in repair reforms very much by fitting a few well selected machine tools, such as a small lathe, a shaping machine and a drill press. It is surprising how many machinery repairs can be made on board, and while the ship is under way, by the engine room force, if they only have the will to make them.

THE WASTE OF FUEL

The use or rather waste of fuel is the matter that needs the most attention from the operating force in the engine and firerooms. As before stated the B. T. U.'s once released have a faculty of running away from useful work, and it is in corraling them that the engineer must devote the best of his abilities. It is much easier for B. T. U.'s to escape up the stack than it is to penetrate dirty boiler tubes and get into the water where they can turn it into steam. Even a sixteenth of an inch of scale or soot on the tubes makes a difference of eight or ten percent in the efficiency of the boiler: hence they should be kept as clean as possible. Improper firing of coal or mixing of air and oil produces horrible waste of fuel, therefore the engineer in charge of the watch should devote himself to studying the best methods of using the coal or oil, and train his firemen accordingly.

It is less work to fire properly than improperly. In charging coal furnaces, the firemen must be quick and snappy, so as to keep the doors open the least possible time. Furnaces should be fired systematically, so that not more than one door is open at a time. Furnaces should not be choked with "crown sheeters," as a stuffed furnace is as bad as a stuffed stomach in a human being. Poor combustion is one result, and a stomach ache the other. Too much oil or too little air results in a bad mixture, and unconsumed oil or smoke results. Black smoke from the stack is a sign of a careless fireman, and a sure way of having wages reduced when the fuel bill reaches the office.

UNLAGGED BOILER SURFACES

Every little weep or hiss of escaping steam in the boilers, piping or engines means the chuckle of some truant B. T. U.'s who are escaping work. Unlagged boiler surfaces or portions of valves and piping make easy exits for more recalcitrant heat units. It is queer how many shipbuilders and superintendents overlook the possibility of cutting down waste by lagging the bottoms of Scotch boilers. They seem to go on the theory that "Oh well! what's the good of trying to keep them warm!! And then they wonder why their boilers leak so badly in the shell seams. Think of a thick steel plate at a temperature of 400 degrees on top and about 100 degrees on the bottom. Do you blame them for weeping?

To accomplish most in the saving of B. T. U.'s I would advise all engineers to get acquainted with the alphabetic symbol, in the person of our old combustion friend, Mr. CO₂. That's what the chemist calls it, but ordinarily he is known as carbon dioxide, that is one atom of carbon makes love to and marries two atoms of oxygen. Mr. Carbon is somewhat of a Mormon

in this affinity but he is much more efficacious in producing good boiler results than he is in a monogamous state, when he runs away with a single atom of oxygen. The best results of combustion are obtained when the escaping flue gases contain as nearly 14 percent of CO₂ as it is possible by correct firing to obtain. In ordinary, careless methods of mixing fuel and air, you are liable to get a mixture containing as low as 9 or 10 percent of carbon dioxide, which means right off a wasting of from 20 to 30 percent of the fuel up the stack.

Naturally chemists and combustion engineers know of these results, but their knowledge does not have any good effect in saving fuel on board ships, unless the men in charge know of and apply this knowledge. Not so long ago it was deemed impracticable to make chemical tests on board ship to determine the composition of flue gases. In stationary boiler plants it has for some time been customary among the more up-to-date engineers to have such tests made and to rate the firemen's efficiency on the way he kept up the proper proportion of carbon and oxygen in the flue gases. Quite recently several manufacturers have designed apparatus, at comparatively low costs, which can be fitted on marine boilers, so that even the uninitiated may read the CO₂ contents as readily as they can a steam gage.

The closing advice to my marine engineer brethren is to get next to some apparatus of this kind and start out on a hunt to arrest these perambulating B. T. U.'s and thus cut down their fuel bills and help to keep up their wages, for which they have my best wishes.

New Passenger Ship for French Line

THE *Lamoricere*, which has been constructed for the Compagnie Générale Transatlantique by Swan, Hunter, & Wigham Richardson Limited, at their Neptune Works, Newcastle-on-Tyne, has just completed her official trials and has been handed over to her owners, so that she may take her place in their mail and passenger service in the Mediterranean. The vessel is built of steel, about 385 feet in length by 50 feet beam, and has been constructed to attain the highest class in the Register of the Bureau Veritas for special service in the Mediterranean with the special mark for watertight subdivision.

Her passenger accommodation is extensive, very comfortable and even luxurious. She is fitted to carry 132 first class passengers, including two cabins-de-luxe suites, the accommodation including a spacious smoking room and conversation room on the boat deck, large dining saloon on the upper deck, and staterooms for one, two and three passengers on the promenade deck and upper deck. The decoration of all these rooms is of the highest type.

The second class passengers, 116 in number, have a well finished smoking room and music room on the promenade deck, a dining saloon on the upper deck and staterooms on the main deck. The third class passengers, 132 in number, have a comfortable dining saloon on the upper deck, while their sleeping accommodation is on the main deck. The lower deck is fitted for the carriage of cargo or soldiers.

The triple screw propelling machinery, which has been constructed by Swan, Hunter & Wigham Richardson Limited, at their Neptune Works, consists of one four-crank triple expansion reciprocating engine, balanced on the builders' well-known Yarrow, Schlick & Tweedy system, and two low pressure turbines of the Parsons type, in conjunction with single reduction mechanical gear. The center propeller is driven by the reciprocating engine and the wing propellers by the turbines. Steam is supplied by six single-ended boilers working under Howden's system of forced draft, and arranged to burn either coal or oil fuel.

On the trial trips the machinery worked without the slightest hitch, driving the vessel at a speed of 18½ knots.

Locks of New Orleans Industrial Canal Controlled by Novel Electrical Switchboard

AN electrical switchboard for controlling the locks of the Inner Harbor Navigation Canal at New Orleans, which is a representation of the actual canal in miniature, has just been designed and built by the General Electric Company. This system, patterned closely after the central boards built for the Panama Canal by the General Electric Company, enables one man as operator, quite out of sight of the canal itself, to control the movements of the lock machinery and see before his eyes just what is happening on the actual canal when he turns the control handles.

CONTROL BOARD

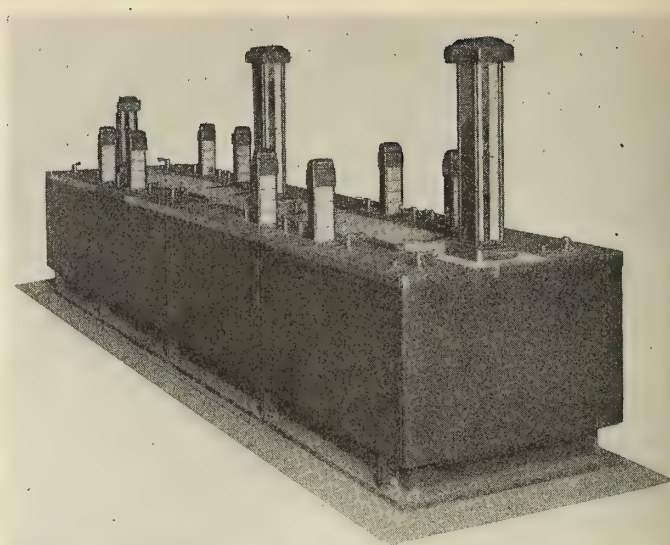
The miniature canal, or control board, is 16½ feet in length and is rated at 110-220 volts alternating current. The switchboard shows the lock chambers of the canal by a stretch of marble slabs, extending from one end to the other of the control board. At various points along the line of this miniature canal, columns rise to various heights. These columns are scaled for reading, and indicate the rise and fall of water in the lock chambers when the operator, by means of the control handles, opens and closes the water gates in the actual canal.

On the top and near the edges of the board are located the control handles. These handles are operated through an angle of 90 degrees. They open and close the circuits to the electrical apparatus which works the lock machinery, located in the walls of the locks. Name plates show the "open," "close," and "off" positions of the handles.

INTERLOCKING ARRANGEMENT

A special arrangement was worked out to take care of the question of interlocking. A series of vertical and horizontal bars is provided, which move in a direction 90 degrees apart. The bars are provided with bevelled stops, known as "dogs," designed to engage one another. When these dogs meet, it is impossible to move one bar until the turning of a control handle has lifted the dog out of the way. Other control handles meanwhile are locked out of action. The Sylsyn system is used as the medium of indication between the lock machinery and the switchboard.

The canal to be controlled by this system will connect the Mississippi river with Lake Pontchartrain and will eventually provide a shorter water route from New Orleans to the Gulf of Mexico. It extends completely across the city of New



Lock Control Board, 110-220 Volts, A. C. (End View), Port Commission of New Orleans

Orleans for 5½ miles. The Inner Harbor itself will be at the level of the Gulf of Mexico, and subject only to tidal fluctuation of the gulf.

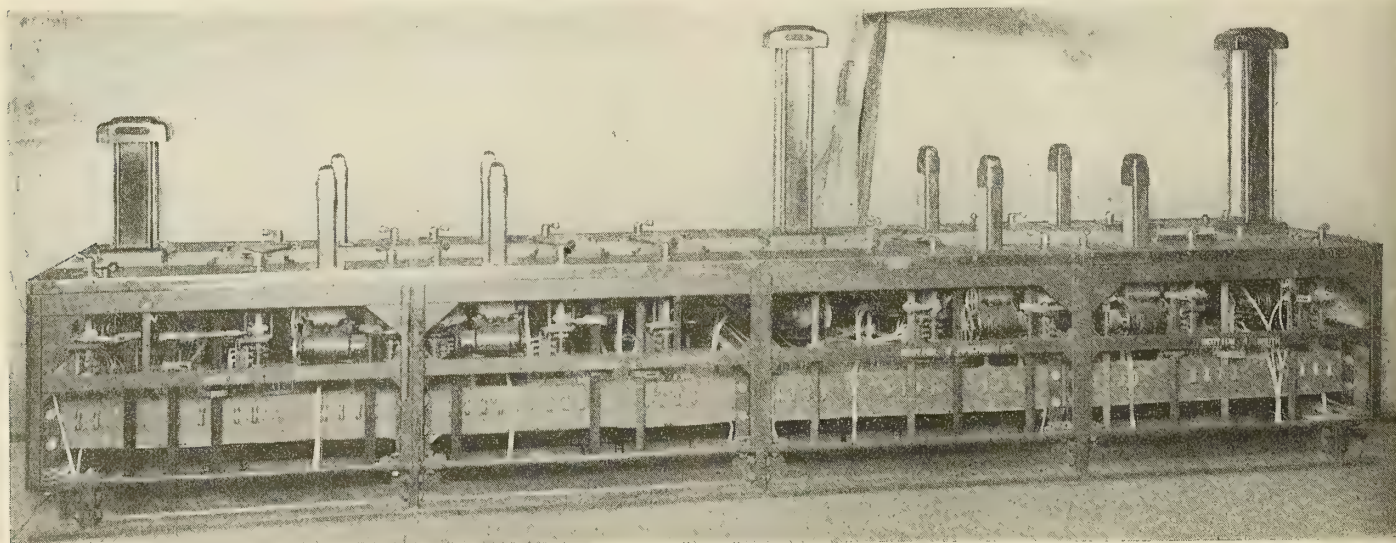
CONCRETE SHIP LOCK

The chief feature of the canal, which will allow for the passage of vessels from the outer harbor, on the Mississippi, into the inner harbor, is a large ship lock of reinforced concrete, which will accommodate a ship up to approximately 20,000 tons. The lock masonry will have a length of 1,050 feet and a usable length of 640 feet; a clear width of 75 feet, and a depth over the sill at low water in the gulf of 30 feet.

The development of the inner harbor provides an addition of approximately eleven miles of waterfront to the port of New Orleans. The work as a whole is about 80 percent complete. It is expected the entire project will be complete and ready for opening to commerce about next July.

This project, when finished, will constitute a link in the great intracoastal canal, which will provide a continuous inland waterway from Boston to Brownsville, Texas. It will form the waterway of least resistance to New Orleans, from the Alabama coal fields.

The control board described above will be the first of its kind installed in the United States and the only one outside the Panama canal zone.



Lock Control Board, 110-220 Volts, A. C. (Side View With Covers Removed), Port Commission of New Orleans

Financing Our Foreign Trade*

Provision for Long-Term Credits Necessary so That the World Can Do Business With Us

BY GEORGE ED. SMITH**

THE business men of the country have watched and waited for more than two years, while the time has arrived when it has been necessary to provide some means for preventing the complete disruption of our export trade. Since the armistice a \$4,000,000,000 trade balance has piled up, and now a further balance finds difficulty in being financed. The National Chamber of Commerce, the National Foreign Trade Council, the National Association of Manufacturers, all agreed long ago that something should be done to solve this great problem.

The opportunity came when Congress passed the "Edge Act," and when a committee of the American Bankers' Association formed the plans for the Foreign Trade Financing Corporation, which by its very size and its nationally representative character, is expected to make real headway in remedying the chief obstacle now in the path of American exporters.

Foreign buyers need American goods more than ever; American manufacturers, business men and farmers need more than ever to supply what the foreigner wants. They have the demand. We have the goods. By supplying that demand we could get rid of that great surplus, could keep busy six days a week instead of four, and could pave the way toward a new position for the United States in the international commerce of the world.

Why can't this be done now?

Because the commercial banks of the United States cannot go on extending long-term loans, and further, because the American dollar is at such a high premium in foreign countries that foreign buyers cannot afford to do business with us on the short-term basis, customary in this country. In granting short-term credits the limit has about been reached. It is only by giving the foreign buyer more time in which to pay for his goods that we can compete successfully with the rest of the world and sell our surplus products abroad.

Now, what is the reason for this four-billion dollar trade balance, and why is it threatening to put us out of business with the rest of the world?

Foreign buyers since the armistice piled up this four-billion dollar trade balance as a result of purchases, which would ordinarily have been stretched out over a period of years. Normally they would have purchased what they needed, and the balance of trade kept practically level, although it was turning in our favor, but instead of taking a sufficient amount of time so that demand would balance demand, or so that we would absorb direct securities from the other side, as England and France did in the past, this balance piled up through an immense one-sided purchasing on the part of foreign buyers in a short time.

Such a thing would not have happened, if this balance of trade had gradually grown in our favor rather than to be dumped upon us. We would have had a gradual balance of trade to even up, and as it was gradual, we would have absorbed securities as the natural way to balance up that trade. It was not possible to educate the people of this country as to the advantage of absorbing foreign securities direct, since they had been a debtor people so long that they do not know what to do as a creditor.

The solution of American labor's greatest problem—unemployment—is the exporting of American time sheets to bring back American payrolls. The products of American workmanship under our present credit system can only go part of the way in reaching the foreign buyer. To reach the foreign buyer, to keep American goods flowing, American industries running, and to bring back work for the four million pairs of American idle hands, there must be provided at once adequate machinery for granting long-term credits in our export trade. Until these long-term credits are available, American cargoes will be halted in mid-ocean, caravans loaded with American goods will be stopped in the middle of their journeys, and a great barrier will remain in place in all parts of the world, checking the flow of American time sheets for the solution of filling American payrolls.

Therefore, there had to be a medium through which to absorb these securities, first investigating their worth, and then pooling them and issuing debentures based on them to the people. It has been felt that the big jump in the balance of trade with its consequent disruption of exchange would, undoubtedly, not have come if securities had been absorbed to correct it. Therefore, let us consider a proposition which will absorb these securities in sufficient volume to have some effect on the balance of trade. This is the reason for the immense size of the Foreign Trade Financing Corporation.

Let us see whether we want securities or not. In the first place, if we do not get securities in payment for the goods we have sent abroad, we are going to get other goods. Do we want a tremendous amount of imported goods dumped in on us? We want raw materials

that we do not produce. We want many things, such as coffee, rubber, sugar, etc., cheaper, so that we will get more of the good things of the world that we do not produce for less of our individual effort. We want imports of certain goods, but we do not want four billion dollars' worth of manufactured goods dumped into the country, when we are now able to produce more of manufactured goods than we can consume. Wouldn't it be better to absorb good securities and have foreign people pay us interest? In the last analysis, we must import goods, gold or securities to settle our trade balance. We do not want the goods—we have taken all the gold foreign people can spare—and now we stand up against a wall because we cannot absorb securities. For the present we have taken more than enough from Europe that is movable. We do not want any more. We must become, as we would have become under normal conditions, a rich investing nation, as every rich exporting nation in the past has always become.

The question then is, whether this country will back up its export trade. It is not a question of whether the Foreign Trade Financing Corporation itself will succeed or not. The question is, whether we can get behind the proposition and by group thinking and concerted action, solve one of the biggest problems that has ever confronted our country. Put it another way, the question is, whether we have to depend upon a crisis to show the country that it ought to have done what the brains of the country are now telling us we ought to know.

* From an address delivered at Editorial Conference luncheon, Associated Business Papers, Inc., New York, February 18, 1921.

** President, Royal Typewriter Company, and member, Organization Committee, Foreign Trade Financing Corporation.

The problem is one which it will take an immense institution to handle. We will say now that we want to solve one particular problem, and I will lay it in front of you concretely.

There is in Australia to-day a market for American automobiles. We are not shipping them. Why? Because there is not a dollar market in Australia at this moment, and for that reason many of our men in Detroit are not working, and we are not producing the automobiles. We must create a dollar market in Australia in order to sell our goods there and keep our men working. How are we going to do it? By long-term credits. Is it right that we should have unemployed workmen in the country when we can by right action revive our market abroad? This is not being done out of charity of our hearts to help people who cannot help themselves. It is not an effort to make the League of Nations work. It is to develop the market for American products outside the United States. Why not take our dollars—put them to work—go on paying our workmen and keep up the prosperity of the country?

We manufacture a tremendous amount of goods in America beyond the amount that is needed for home consumption. Naturally we cannot sell them in America. We need outside markets to dispose of them. When we cannot do this, there is unemployment for the men who manufactured these goods. When all is said and done when we export, we export labor. Labor is the biggest part of all goods we export. Take the automobile. The manufacturer of this article does not make ten percent profit on his turnover. If he did, he would be many times a millionaire. No, he makes nearer 5 percent. Fifteen percent of his cost goes to buying raw materials. The remainder goes into labor. In the end, more than 75 percent of his cost goes to the workman. What, therefore, we are trying to do is to take the time sheets out of the factories of America, export them, and bring back payrolls for our American workmen.

When you finance foreign trade, you only finance the time of our American workmen a bit further to its ultimate consumer.

Let us take the automobile again. Suppose that you grant three months' credit. Where will that three months take the automobile? Make it simple. Probably to the top of the Andes Mountains, or half-way across the Pacific Ocean. In three months the automobile has not reached the ultimate consumer. You haven't got it far enough toward the payroll for your workmen's time sheets.

Some time ago, we, as manufacturers, sat back and said to the parties in the other countries, "Come to our factory and get the automobiles, and pay us cash." The farmer said, "Come and get my corn from the farm or the local elevator, and pay cash." When our exports began to decline, our producers relented a bit, and financed their goods to the port of shipment, letting the buyer take and pay for them there. Now our exports have shrunk so far, and our available financial machinery has become clogged so much, that we cannot carry the goods any further along to the ultimate consumer. It is impossible for the foreign buyer to take goods on the terms made available by our commercial banks, and therefore we cannot sell the goods.

The explanation is very simple. We haven't the machinery to carry our work to its ultimate consumer. We used to say to the buyers, "You come and take our goods and use your own money to finance them." Now that we can no longer do this, we must either stop selling or find some way to carry our goods further along to the people who use them and consume them.

This is not the bankers' problem alone. It is the people's problem. It requires *group* thinking, *group* action.

Look at the people of Great Britain. They eat, sleep, work and live in export trade. There are forty million people thinking of export trade. Look at what they have done in

export trade. Then wouldn't we rather have forty million people solidly back of the proposition to finance our exports than a hundred million people uninterested and unconcerned? This same thing is true of France and Germany.

I think that having a hundred million people, all wearing the same hats, the same clothes, the same ties, the same shoes, all eating the same things, is a tremendous advantage for any nation. It gives a standardized market for the products of the country. That gives us a great advantage in going out and selling these standardized goods in the world's markets. But this great body of one hundred million people is unorganized, and you know that an unorganized majority in many cases will not do what an organized minority could.

The answer is this: We must educate the people. We must bring about group thinking, making the people realize that what we are doing is putting machinery in operation, which will back their payroll. We must make them understand that it is their problem. If all of us sit aside and wait for somebody else to act, the task will never be done.

I am thoroughly convinced that what we need in this country is to think together, work together, act together, in a real spirit, and then the financing of our foreign trade will go over and be one of the greatest propositions of the world.

Hydraulic System for Stowing and Handling Fuel Oil on Board Ships or in Yards or Docks

THE sketch accompanying this description shows the adaptation of a hydraulic system for the control of the fuel oil of a large dredge. The solid lines show the run of oil piping from the tops of the various tanks to the oil control manifolds. The dotted lines show the run of the water piping from the bottoms of the corresponding tanks to the water control manifolds.

In this drawing the manifolds are located so as to avoid crowding the space on the floor of the boiler room and to relieve the pressure on the tank tops. A filling main from either side enables oil to be delivered directly to any selected tank.

The water control manifolds are connected to a convenient source of water supply, but preferably to the condenser discharge as well as to a main from a water pump.

DOUBLE CONNECTION OF WATER CONTROL

The purpose of the double connection is that in ordinary feed to the burners the water from the condenser discharge is in more than sufficient quantity to keep the booster pumps flooded, while the water pump is used directly for the purpose of transfer of oil from any tank or tanks to any other tank or tanks or overboard.

The water pump is equipped with a special double ported transfer valve so designed that the operation of a single lever enables the operator to discharge water from the tank from which oil has just been transferred overboard without further action than to pull the lever of the valve. It is not necessary to stop the pump nor to operate other valves.

The run of the piping on these diagrams is shown as direct as possible, but it is immaterial that these runs should be exactly as shown if necessity requires some detour around obstructions. The pipe line sizes are of customary dimensions for the oil piping, while the water piping is generally smaller.

ADVANTAGES OF SYSTEM

It is in the detail of connections of piping and in the calculation of various heads and in the enlargements at certain necessary points that the functioning of the system is effected. It has been found that the run of the piping is in many cases appreciably less than with the old suction system.

When the ship's fuel is handled by this system it is possible

to dispense with transfer pumps, vent pipes, high and low suction, expansion trunks and special settling tanks. This means that the initial economy is noteworthy. With this system of stowage of oil certain phases of expense are moderately reduced and there is an appreciable saving, especially with the lighter oils in the volatilization of the lighter components. Operation by this system is safe, more convenient and cleaner.

Two essential facts in connection with this system are: First, the fuel stowage tanks are kept completely filled with liquid; second, clean oil is fed from the top of the tank.

Some of the features under the first fact are:

(a) By keeping the tanks always full of liquid, no air can come in contact with the fuel in stowage and therefore no gases can form. This automatically eliminates all dangers from fires and explosions arising from such gases.

(b) It prevents the deterioration of oil because no gases are allowed to form.

(c) The tanks being full, there is no free surface of fluid. Surging, with its dangers, is prevented. The strain and stress on bulkheads are eliminated and also the rupture of the joints and connections.

(d) The metacentric height of the vessel may be more accurately determined and better stability conditions obtained, as no allowance is necessary for partially filled tanks.

Some of the features under the second fact are:

(a) Only clean oil can be delivered to the supply tank pumps, burners, carbureters, bearings or other destinations for use.

(b) The elimination of foreign matter from the oil prevents the clogging of valves, burners or carbureters and the cutting of the pump cylinders and pistons.

Any oil that is in condition to flow is very readily handled by this system. This means that where heating is necessary in the suction methods it is also necessary with the hydraulic method.

The transfer of oils from docks to boats or vice versa is accomplished without discharging dangerous and obnoxious gases into the atmosphere in the vicinity of the vessel.

The trim of the vessel can be effected by the hydraulic system, the more readily the lighter the oil in question. The draft of the vessel and also the trim can be maintained practically constant as required. On the other hand, any tank may readily be emptied to lighten the vessel, and the tank so lightened can be made safe with much less steaming than under present practice. Valves or other safeguards deemed advisable, which are not in direct opposition to the principles actuating this system, can be used as desired.

This system has been investigated and approved by the United States Steamboat Inspection Service, the American Bureau of Shipping, Lloyd's Register of Shipping and the British Board of Trade. The system is especially applicable to the installations of oil burning galleys where trouble frequently arises under present methods.

DESCRIPTION OF OPERATION

A description of the operation movements required with this system shows that it is not necessary to go from one end of the ship to the other to manipulate valves and that the frequent accidents due to this are avoided.

FILLING

Pull the levers of the oil control valves of the tanks to be filled. It is not necessary to touch the water control valves; they are in such a position that water is discharged in equal amount with the oil taken aboard.

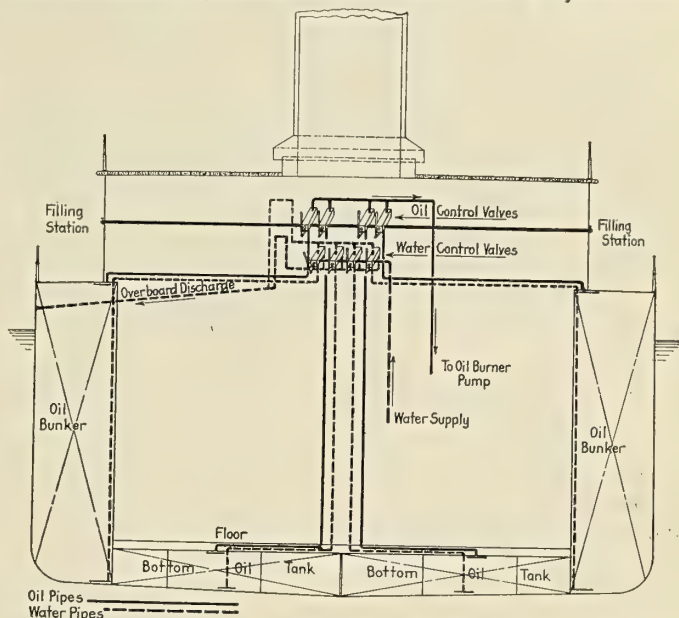
TRANSFER

To transfer fuel from a bottom tank to a high tank, for example, open the respective oil control valves by pulling their levers and pull the lever of the water control valve of the tank from which the transfer is made. If there is haste to complete the transfer, the water pump should be put in service, otherwise transfer will slowly take place from water drawn from the condenser discharge.

OIL TO BURNER

As the oil is always on the burner line, nothing more is necessary for delivery than to regulate the valves of that line as usual.

It is possible to arrange that the tanks' contents may be known at any time by consultation of specially designed pneumercator gages and alarm may be given as the tank approaches the condition of full or empty. The matter of alarm may be covered by one of two methods. One is by the use of



A Simple Transfer System, Showing Oil on the Burner Line from the Port Wing Tank—Water Control Valve, Only, in Use

For transfer from starboard to port wing tank, pull oil control levers, for these tanks and also water control valve for starboard wing tank. If there are more tanks than shown, it is necessary to add one valve for each to the water and oil control manifolds, respectively.

an electric relay, which is entirely safe and simple, and the other is by an attachment to the gages.

A feature of this system is the fact that it is subject to instant control in emergency. The tanks, being full, are safe in any case, but in emergency the pushing of an electric button prevents the feeding of oil in the entire system or in any distinct part of it. In the event of the piping being carried away, oil from the tanks cannot be discharged within the ship.

In other applications of the systems for stowage on shore for the service of vessels the advantages are equally definite. Where conditions permit, it is possible at the extreme range of the adaptation to provide an entire system regardless of the size without valve of any sort other than the valve on the end of the delivery line. In ships, tenders, yachts, scows and other craft similar systems are readily designed.

It may be noted that the principles involved have been successfully used for land installations for some fifteen years and are standard with many companies from one end of the country to the other.

CLASSIFICATION OF EXPORT COAL.—A co-operative agreement has been effected between the Tidewater Coal Exchange, Inc., of New York, and the United States Bureau of Mines for the classification of coal shipped for export through the ports of New York, Philadelphia and Baltimore on a basis of accurate sampling and analyses. The agreement provides for the establishment of limits and tolerances of quality for certain pools and for the maintenance of the quality of the pools within the limits specified. The agreement applies to coals shipped from Pennsylvania, Maryland and northern West Virginia. In 18 months 48,000,000 tons of coal, in approximately 1,000,000 cars, were shipped from these districts through the Exchange.

Rules and Regulations for Freeboard*

Review of Regulations in Foreign Countries Governing Freeboard —Discussion of Requirements for Ordinary Sea-Going Cargo Vessels

BY DAVID ARNOTT

THE freeboard of a vessel is usually defined as the height of the side above the load waterline at the middle of her length measured from the top of the deck at side and marks the limit of loading which is considered consistent with the maintenance of a proper factor of safety under all conditions of wind and weather. Freeboard rules and regulations are an endeavor to define this limit, and one can readily understand that the problem of fixing a safe load line for a complicated floating structure moving through and supported in a constantly varying degree along its length by a fluid which is itself in motion does not lend itself to simple mathematical treatment.

There are, however, obvious and essential considerations which must be kept in view in determining the proper freeboard for any vessel:

(a) The provision of that height of platform which will prevent any undue tendency to ship water aboard with consequent deck damage and which will insure the crew getting about the deck in heavy weather with, if not comfort, at least comparative safety.

(b) A reserve of displacement, i. e., reserve or spare buoyancy, must be provided as a margin against possible leakage and entry of water into the holds.

The freeboard as determined from the above considerations has been termed the geometric freeboard and is the minimum freeboard allowable having regard to the vessel's dimensions, form and type.

(c) The vessel must have a sufficiency of structural strength to render her safe when loaded to the minimum or geometric freeboard.

As a ship, like any other structure, must be designed for the load to be carried, freeboard and strength cannot be disassociated and the inclusion of a definite standard of strength in any freeboard regulations is essential.

(d) If the vessel has a deficiency of structural strength as compared with that of the freeboard standard, the freeboard must be increased in order that the reduced load carried will render her relatively as safe as the standard vessel.

Although the present load line bill before Congress appears to be the first serious attempt to provide load line legislation for this country, the desirability of placing some limit on loading seems to have been recognized for many years prior to 1917, at which time the United States Shipping Board took definite action and issued instructions that load lines be marked on all vessels building and to be built for the Emergency

Fleet Corporation. Marine underwriters, as one would expect, had always endeavored to see that the loading of vessels in which they were particularly interested was kept within reasonable limits and their surveyors had instructions to report cases where, in their opinion, vessels were overloaded to an undesirable extent. The American Bureau of Shipping's "old rules" emphasized the importance of adhering to general principles by which the amount of freeboard for safety might be determined and contained a general table of freeboard allowances which varied from $1\frac{1}{2}$ inches per foot of depth of hold at 8 feet to $3\frac{3}{4}$ inches per foot at a registered depth of 30 feet for full scantling vessels, with one-half of this allowance for hurricane deck vessels. In the case of vessels of the latter type in which the deck below the superstructure, or hurricane deck, was the main strength deck, the minimum freeboard proposed required to be submitted to the committee before classification was granted.

Mr. Lewis Nixon, in a paper before the Society of Naval Architects and Marine Engineers in 1897, while criticising certain minor features of the British freeboard tables in force at that time, gave expression to his own personal opinion regarding a compulsory load line in these words: "It must not be assumed that the general opinion of having a definite safe freeboard for vessels is wrong, for as it stands this is a very wise law, and if it is administered impartially and without undue interference with trade it is of the utmost value to floating property." In the discussion following the reading of his paper it transpired that a bill to regulate freeboards,

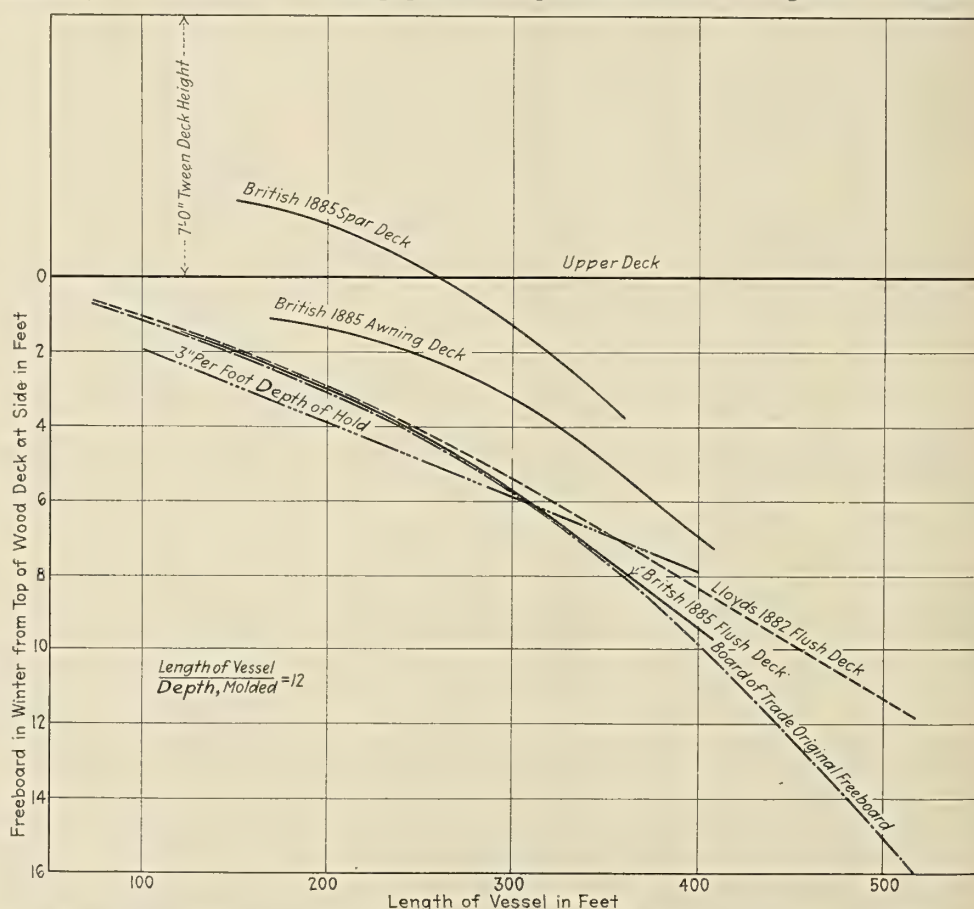


Fig. 1.—(Steamers) Comparison of Early British Freeboards With British 1885 Freeboard Tables

* Paper read before the Society of Naval Architects and Marine Engineers, New York, November, 1920.

particularly for lake vessels, had been introduced into Congress some years before but was dropped when it was pointed out that most of the channels of the Great Lakes would not allow of vessels being loaded to their proper freeboard. The opinion was also expressed that freeboard was not so vital a question in the United States as in some other countries, owing to the limited draft of harbors and the extensive use in the coasting trade of hurricane deck vessels with sides high out of water.

It is interesting to note that as long ago as the year 1874 the enterprising builders and shipowners of the Great Lakes district met in council at Buffalo and not only came to the conclusion that the marking of a load line on both ocean-going and lake vessels was desirable, but after mature deliberation formulated rules for freeboard and drew up a set of construction rules for wooden vessels in which a laudable endeavor was made to assess the dimensions of the various timbers entering into the structure with some regard to the strength required instead of tabulating scantlings on the basis of the vessel's tonnage as was the practice of the time, the molding of the floor timbers, for example, being fixed by the length of the floors and the load draft. The freeboard rules recommended by the Buffalo convention were intended to apply only to vessels of the highest class in existence at that time.

The first legislation in Great Britain dealing with the loading of vessels was the Merchant Shipping Act of 1871, which contained the provision that seagoing vessels must have draft marks at the stem and stern and required that the load draft

of a vessel should be recorded before leaving port. The law was useful in that after this date reliable evidence with regard to load draft was available when investigating the losses of ships at sea. Although a royal commission, appointed as a result of the popular agitation led by Samuel Plimsoll, reported that the enforcement of any standard freeboard regulations would be disadvantageous, if not impossible, the continued interest of the public forced the passing of the Merchant Shipping Act of 1873, which provided for the detention by the Board of Trade of overloaded and improperly laden vessels. The Merchant Shipping Act of 1875 required owners of foreign going vessels to mark a circular disk on the sides at the maximum draft, to record the amount of this freeboard before clearing at the custom house and to insert this record in the agreement with the crew; the Act of 1876 made these requirements compulsory for all British vessels except coasting vessels under 80 gross tons, fishing boats and yachts.

It should be noted here that, although an owner was compelled by the foregoing legislation to mark load lines on his vessels, the position of the load line as indicated by the disk was entirely a matter of personal opinion and could be altered from voyage to voyage. The officers of the Board of Trade had power to detain a ship which was overloaded, but as there were no legally recognized freeboard rules from which to determine the limit of loading, one can readily imagine the endless disputes which arose between owners and officials as to what constituted an overloaded ship within the meaning of the act.

A conference which was called in 1875 to ascertain the

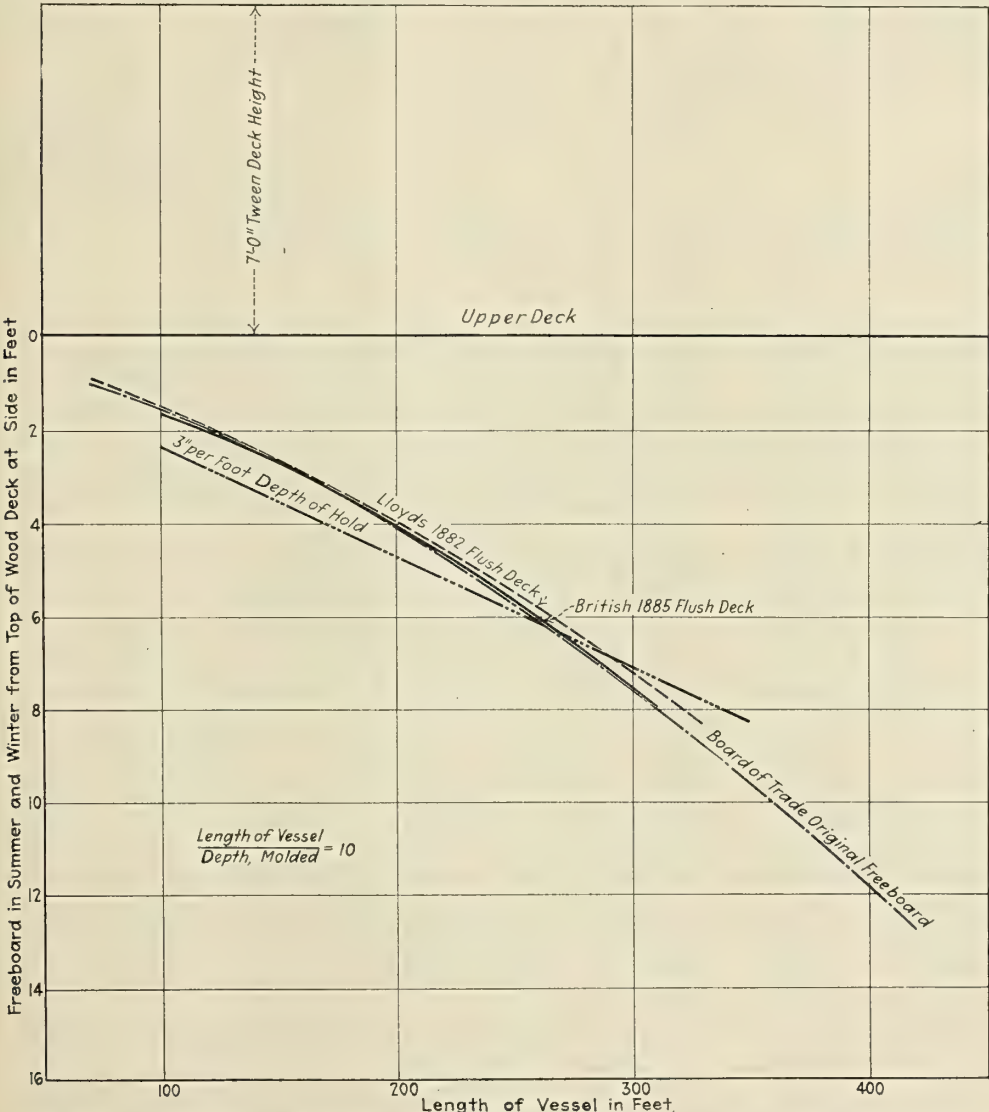


Fig. 2.—(Sailers) Comparison of Early British Freeboards With British 1885 Freeboard Tables

practicability of laying down rules for guidance of the Board of Trade surveyors was abortive as far as the direct object of the meeting was concerned, although agreement was reached on certain fundamental principles which it was considered should govern the determination of freeboards. Upon the introduction of spar and awning deck vessels Lloyd's Register of Shipping made the marking of an approved load line on these special types a condition of classification and in 1882 published freeboard tables capable of general application which were based on reserve buoyancy percentages. At about the same time the Board of Trade issued freeboard rules for the guidance of the surveyors, and as there was also in use a scale of freeboard allowances recommended by the Liverpool Underwriters' Registry, the necessity of endeavoring to arrive at a uniform basis for determining freeboards was urgent.

The first load line committee was appointed by the Board of Trade in 1883, and after extensive investigation reported in 1885 "that it is now practicable to frame general rules covering freeboard which will prevent dangerous overloading without unduly interfering with trade."

All obtainable evidence as to what constituted a safe loading for vessels was collected from owners and masters and the freeboard tables recommended by the committee embodied the results of ripe

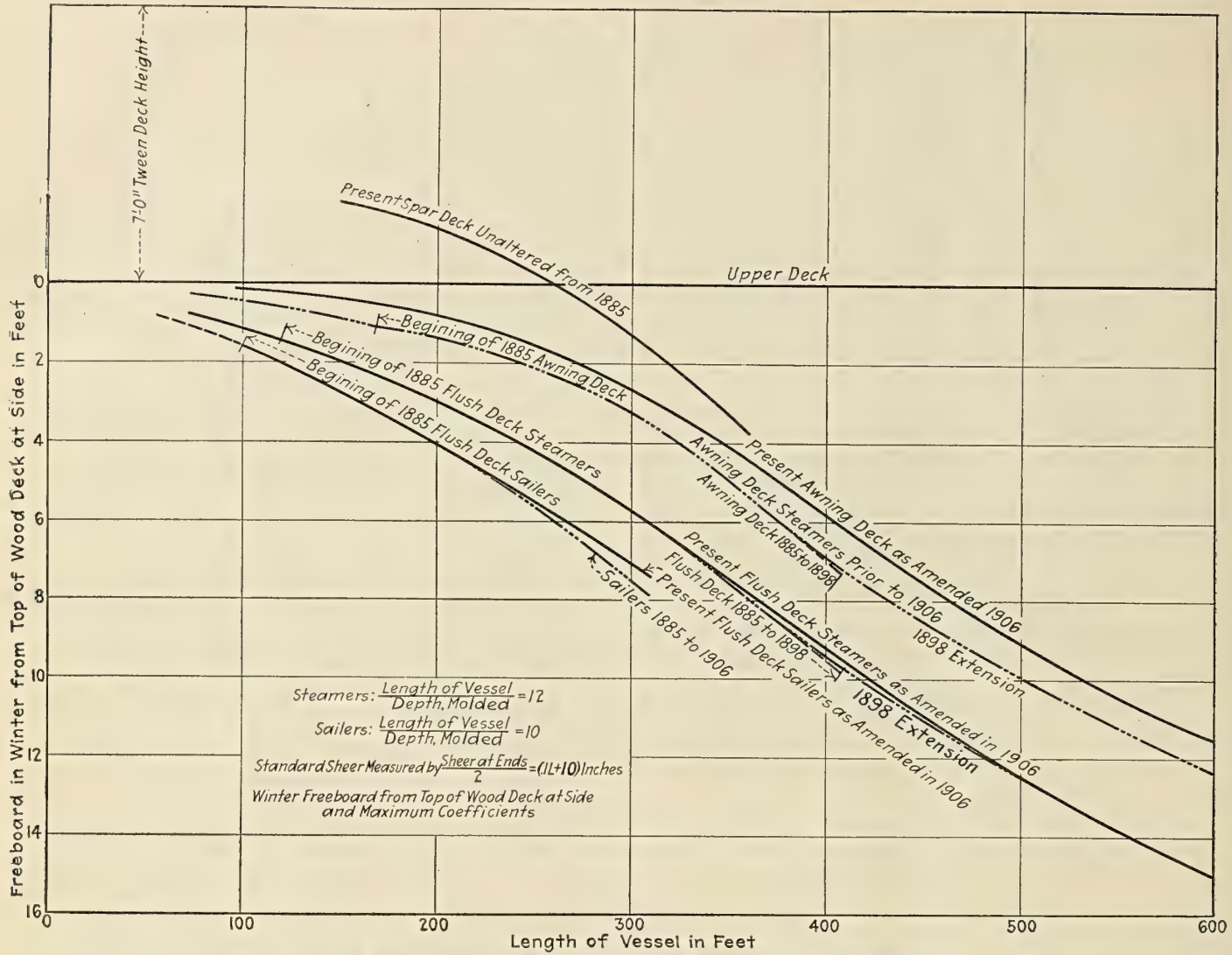


Fig. 3.—Showing Alterations Made to British Freeboard Tables Since 1885

practical experience within the limits of the dimensions of vessels existing at a time when a cargo vessel of 300 feet in length was considered a big boat. These rules, which were based on Lloyd's 1882 tables, were approved by the Board of Trade, and a large number of shipowners, to their credit be it said, voluntarily took steps to have freeboards marked on their vessels in accordance with the new regulations, although not legally required to do so, since it was not until 1890 that the Merchant Shipping Act of that year provided for the compulsory marking of all, except some of the smaller class of British vessels, with freeboards as recommended by the 1885 load line committee. Lloyd's Register and the British Corporation were empowered by the Board of Trade to assign freeboards and the act itself contained a clause to the effect that due regard should be paid to the views of the assigning bodies in administering the regulations and in the making of any modifications in the freeboard tables which might be found necessary. This undoubtedly has had much to do with the fact that load line administration in Great Britain has never been oppressive and that the freeboard rules and regulations have been modified from time to time in order to keep pace with the development of shipbuilding and the evolution of new types of vessels.

The Merchant Shipping Acts of 1894 and 1906 extended the provisions of the previous acts, the 1906 Act cancelling the exemption previously granted to coasting steamers under 80 tons gross and requiring all foreign vessels in British ports to have load lines marked in accordance with the British or other freeboard regulations considered equally effective.

It may be worthy of mention here that under the regula-

tions made by the Board of Trade, by virtue of the authority granted under the Merchant Shipping Act, a vessel must be maintained in good condition to continue to hold a freeboard certificate. Freeboard certificates, in the case of classed vessels, remain in force as long as the original class is maintained, except in the event of structural alterations being carried out to deck erections, etc., which may have affected the freeboard assigned. In the case of unclassed vessels freeboard certificates are issued for a period not exceeding four years, depending on the age and condition of the vessel. In the event of a vessel's class being cancelled or alterations made to the hull structure which affect the freeboard and where the time for which a certificate was granted has expired, the freeboard certificate must be handed in for cancellation and application made for a new certificate, otherwise the Board of Trade officers may notify the collector of customs who has power to refuse clearance of a vessel on this account. A freeboard certificate is issued only after the markings have been verified and permanently cut in on a vessel's sides. The particulars on the certificate must be entered in the official log and the freeboard certificate framed and kept aboard the ship.

The 1885 load line committee's freeboard tables, which in 1890 became the legal regulations, were based on Lloyd's 1882 tables modified to agree with the views of the Board of Trade with regard to the value of erections, provision for the height of platform in the larger vessels and the differences in freeboard for season of the year and trade, i. e., summer, winter and winter North Atlantic. The table freeboards for flush deck steamers and sailers were based on reserve buoyancy, varying from 22 percent in the case of a steamer 120

feet in length and of standard proportions to 35 percent for a steamer 408 feet long, the effect of the length corrections and coefficients of fineness given in the tables being to give the same percentage of reserve buoyancy to vessels of the same length. The awning and spar deck table freeboards were determined on a basis of the strength of the Lloyd's rule awning and spar deck vessels of that date. Figs. 1 and 2 show the 1885 table freeboards for steamers and sailers in comparison with the original Lloyd's 1882 and Board of Trade freeboards, these early British freeboards having been reproduced from a similar diagram in Foster King's paper read before the Institution of Naval Architects in 1906, entitled "Notes on Freeboard."

The standard of strength laid down for use with the tables was Lloyd's 1885 rules, in which definite scantlings were tabulated for full scantling spar deck and awning deck vessels on a basis of numerals. Owing to the improvement in distribution of materials which came into vogue about the time the first British Corporation rules were issued in 1893, so-called spar deck vessels were being built relatively as strong as the 1885 three deck vessel and were assigned minimum freeboards on the basis of a strength comparison. A similar situation exists today in the modern "shelter deck with freeboard" vessel, in which the scantlings are somewhat less than full scantling classification requirements, and the granting of the minimum freeboard to this type can be justified only because of the lower standard of strength allowed by the freeboard regulations.

The German freeboard tables were, in effect, the British tables improved and modified to suit the changes which had taken place in types and construction of vessels since 1885. The German rules contained tables of freeboards for both full scantling steamers and sailers, also for awning deck vessels, but no separate table was given for spar deck vessels. The depth used with the tables was measured to the top of the deck, whether of wood or steel, and the table freeboards were given from the top of the deck to the center of the disk, i. e., summer freeboards instead of winter freeboards as in the British regulations. As considerable improvement had taken place in the distribution of material, with a corresponding increase in the strength of vessels with complete superstructures, the reduction in freeboards granted by the German tables to vessels of the awning deck type was justified on that account. The new German sheer standard, which was considerably above that of the British tables, was also more in line with modern practice. Fig. 4 shows the comparative sheers in the case of a 400-foot vessel.

While in the British tables no correction is made for excess or deficiency of sheer in the case of awning or spar deck vessels, awning deck vessels in the German tables received an allowance for excess of sheer over the standard and were penalized for deficiency of sheer in the same way as for flush deck vessels. Detailed instructions were given for the method to be adopted in assigning freeboards on the basis of strength, the standard of strength adopted for use with the tables being the 1903 Germanischer Lloyd's rules. Vessels carrying wood

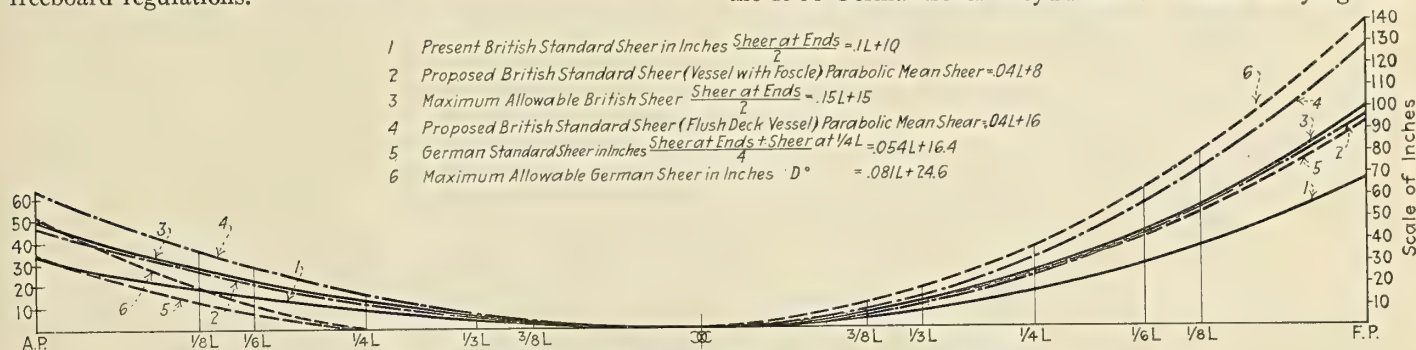


Fig. 4.—Diagram Showing Standard Sheers for a 400-Foot Vessel

Except that explanatory notes were added in later editions in order to insure a uniform method of calculating freeboards on the part of the assigning bodies, no major changes were made until 1898, when the tables were extended to include vessels of 50 feet molded depth, as shown in Fig. 3. Methods of determining the freeboards of special types, such as turret deck and shelter deck vessels, were added to the regulations at this time and modifications were also made in the freeboards of vessels engaged in the winter North Atlantic trade.

As the publication in 1903 by the German Marine Association of freeboard rules which differed appreciably from the British regulations strengthened the hands of those who had been urging a further revision of the British tables, it may be desirable at this stage to draw attention to the departures made from existing British practice. Before the advent of load line legislation in Germany a large number of German vessels had freeboards assigned by one or the other of the British assigning bodies, but in 1900 the German Marine Association, having decided that some control over the loading of vessels was desirable, issued instructions to owners to report the draft of their seagoing vessels on each voyage, together with the amount, nature and stowage of cargo carried. The results of this investigation were submitted to the Germanischer Lloyd's and in 1903 the freeboard rules proposed by that classification society, as amended in conference with representatives of the shipping and shipbuilding interests, were finally adopted and received the approval of the German government in 1904.

in holds and having deck cargoes were allowed less freeboards than given by the tables provided they had sufficient stability, but no method of estimating this deduction was given. Small coasting sailers under 100 tons gross were allowed to load in summer deeper than given by the tables by a maximum allowance not exceeding the reduction allowed for loading in fresh water, and no addition was made to the freeboards either for steamers or sailers engaged in the North Atlantic trade in winter.

Owing to the reduction in freeboard granted to awning deck vessels it was found that the new German regulations gave reductions in the freeboards of vessels with long erections, as compared with the British, which were so considerable that it was evident that modifications would be necessary either to the British or German tables, or both, before the governments concerned could accept each other's regulations as being mutually effective.

In order to meet the situation which had arisen owing to the introduction of the German freeboard rules, the British Board of Trade called a conference of the assigning bodies, with the result that drastic alterations were made to the British tables, which had the effect of allowing considerable reductions in the freeboards of the majority of vessels, it being estimated that the reductions in freeboards granted represented an increased carrying capacity for British shipping of 1,000,000 tons. The freeboard tables, with the exception of the spar deck table, were modified and the amendments are shown in Fig. 3, which indicates clearly the considerable re-

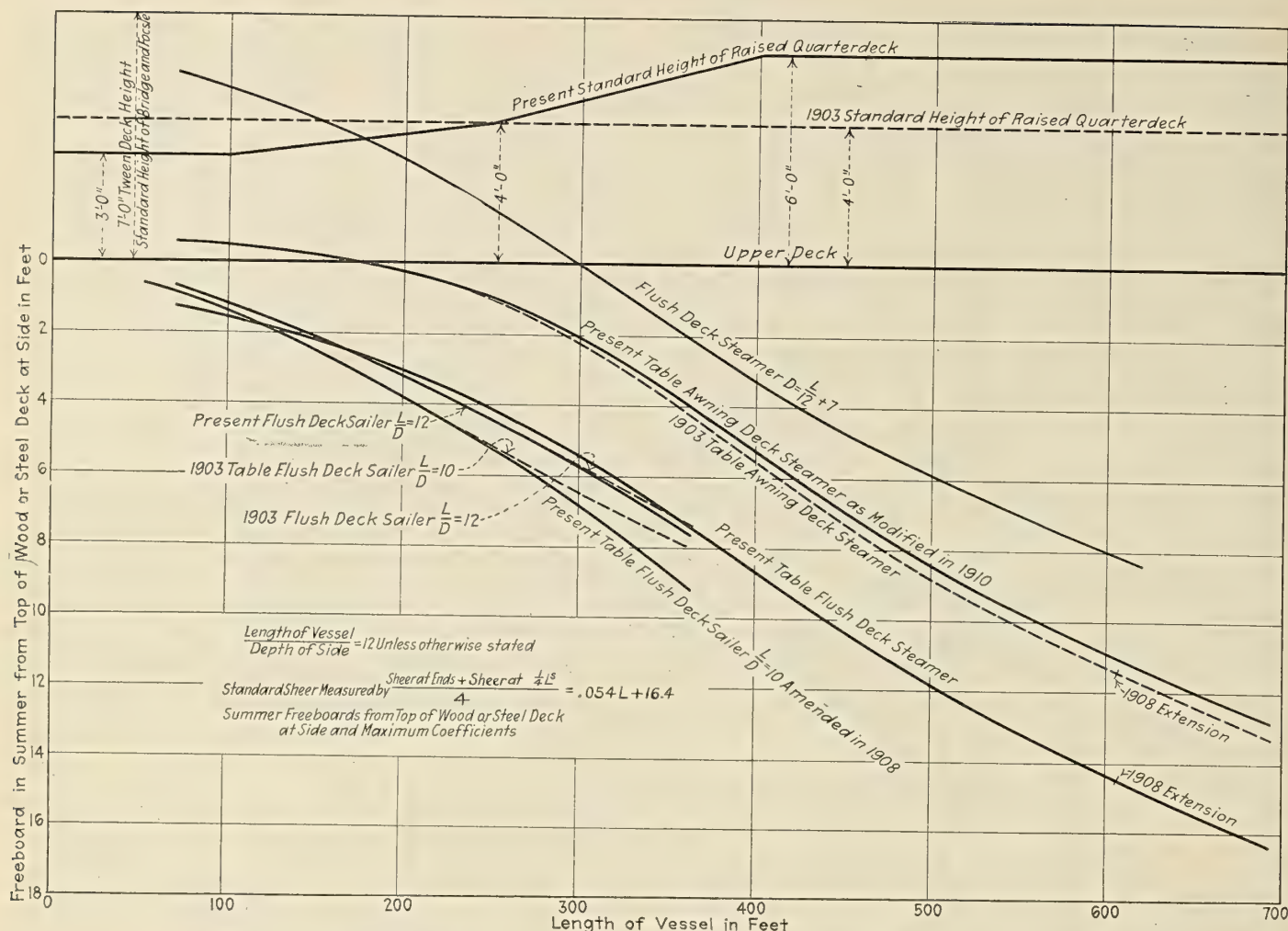


Fig. 5.—Showing Alterations Made to German Freeboard Tables Since 1903

ductions made in the freeboards of awning deck vessels, the fairing up of the flush deck freeboard curve from 28 feet to 42 feet molded, and the reductions made to the freeboards of the larger sized sailing ships.

The increased drafts allowed by the new awning deck table necessitated a higher standard of strength for this type, and the old standard, i. e., Lloyd's 1885 awning deck rules, was augmented by the addition of heavier topside scantlings. In addition to the table alterations the allowances for erections were modified, consideration was given to the freeboard of vessels with scuppers and other openings in the side and it was decided that the maximum reductions under the revised regulations should be granted only where the means of closing all such openings were satisfactory, the machinery casings above the upper deck were of sufficient height and strength, and the hatchways, hatch covers, etc., were efficient and in good condition. When these conditions were not complied with, the freeboards were to be increased, due regard being given to the vessel's trade.

In 1908, with a view to bringing German freeboard tables into line with the revised British requirements, modifications were made to the erection allowances and more detailed information was given for dealing with the freeboards of special types such as shelter deck vessels with tonnage openings. The provisions contained in the British 1906 rules with regard to the protection of openings, nature of appliances required for closing openings in erection bulkheads, height and strength of machinery casings and cargo hatches, and the requirements as to ports, scuppers, etc., were all included in the 1908 German rules. The British practice of adding to the freeboards of vessels engaged in the winter North Atlantic trade was adopted and the special consideration previously

given to wood cargo vessels and small coasting sailers was cancelled. The flush deck and awning deck tables were both extended and increases were made to the table freeboards in the case of the larger sized sailers. In 1910 the German awning deck table was modified as shown in Fig. 5.

The latest British load line committee was appointed in 1913 to advise the Board of Trade on the attitude to be adopted by the British representatives at a forthcoming international conference on load lines and also to investigate and report as to whether the 1906 revised tables required further revision in the light of experience. Owing to the outbreak of the war, however, this conference was never called and for the same reason the issue of the committee's report was delayed until the end of 1915. The decisions given by courts of inquiry into the loss in 1912 of two vessels whose freeboards had been reduced in 1906 caused considerable comment and probably had something to do with the terms of reference. In one case the court had found that the primary cause of the loss of the ship and lives was her insufficient freeboard, and in the other, while the loss of the ship was not attributed to lack of freeboard, the opinion was expressed that the freeboard granted under the revised regulations was dangerously small. It is not the purpose of this paper to go into detail with regard to the findings of the committee, as copies of the report (published in 1916) are easily obtainable, but anyone who has studied it will agree that the report is outstanding in respect to the importance of the recommendations made and somewhat unique from the fact that underlying reasons on which the recommendations were based are stated in detail.

In investigating the effect of the 1916 revision of the freeboard tables every consideration was given to the record of

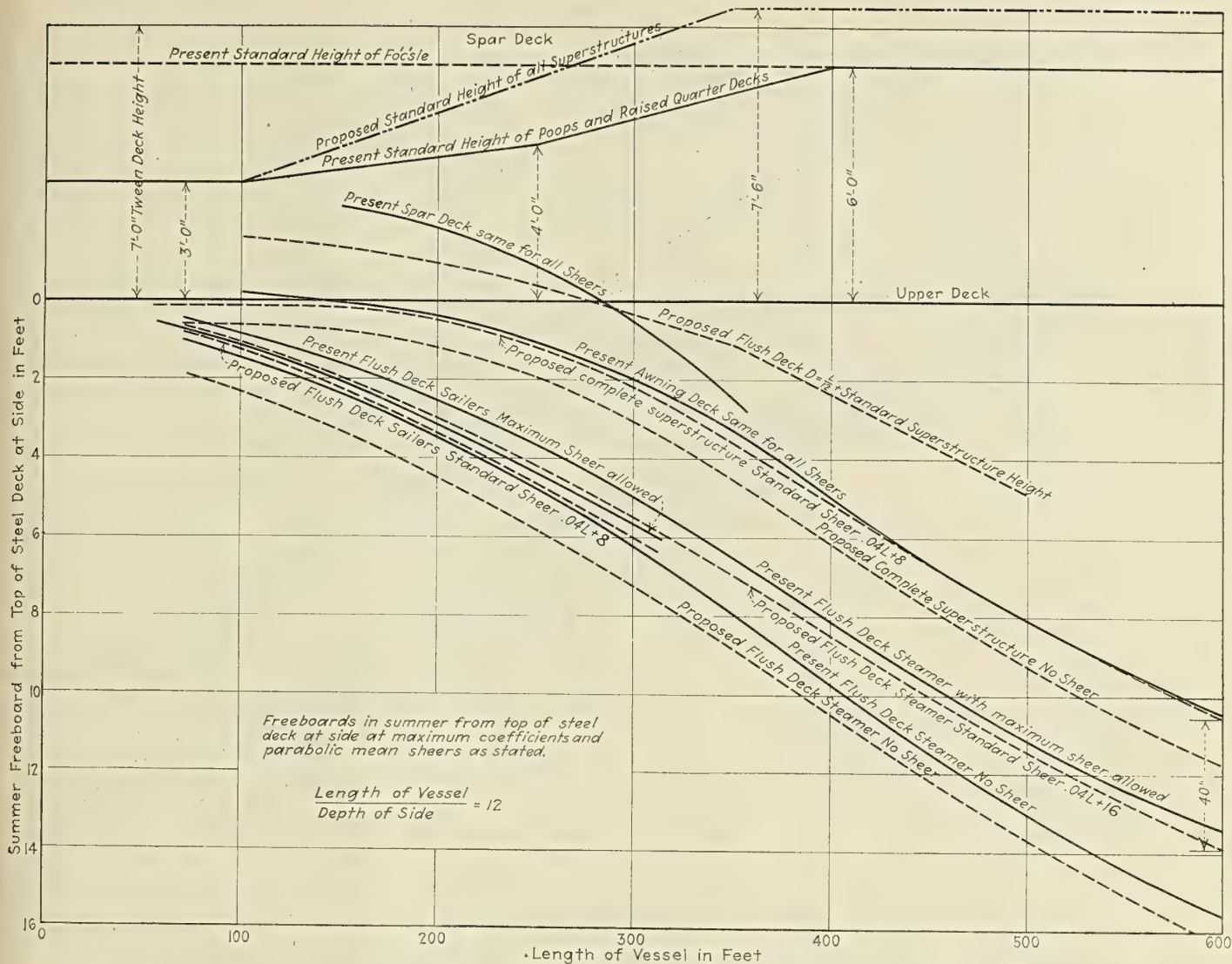


Fig. 6.—Comparison of British Load Line Committee's Proposed Freeboards With Present British Freeboards

shipping casualties and to the experience of shipowners and masters as to the behavior of their vessels since they were marked with the new load lines, the classification societies being also consulted as to the practical working of the revised freeboards over a period of seven years and their effect upon the number and nature of actual damages sustained to classed vessels. The load line committee, after reviewing the evidence in the two courts of inquiry mentioned above, decided that insufficient freeboard had nothing to do with the loss of either vessel and came to the conclusion that there was no foundation in fact for the allegation that the 1906 revision of the freeboard tables had caused a considerable increase in the number of losses of vessels. The opinion was expressed, however, that although the freeboards allowed by the revised tables were quite sufficient to insure the safety of vessels, the reduction in freeboard in some cases had had the effect of making the ships less comfortable owing to the greater liability for water to come on board the weather decks.

The subcommittee which was appointed to deal with the highly technical questions involved in freeboard, having decided that the present British regulations were not adapted for an international standard, proceeded with their investigations with a view to evolving new freeboard rules and regulations suitable for submission to an international conference. The existing British rules, owing to the many additions, modifications and amendments made since the first issue in 1885, had become complicated and somewhat difficult to apply and did not treat the different types of vessels in an equit-

able manner. Every endeavor was made in drawing up the new freeboard regulations to make the rules simple and easy of application, and the result of the committee's labors is embodied in their proposed rules for the assignment of load lines to merchant vessels which are undoubtedly a considerable improvement over the present regulations.

Fig. 6 shows the proposed new table freeboards in comparison with the present British tables, and Fig. 7 a comparison with the present German tables. There are now two distinct sheer standards, parabolic curves the sheer aft, one for vessels with forecastles and a higher standard for flush deck vessels (Fig. 4). Although all types of vessels are penalized for deficiency of sheer as compared with the standard, it is not proposed to grant any allowance for excess of sheer over the standard. Block coefficients at 85 percent of the molded depth are used with the tables instead of coefficients of fineness derived from under deck tonnage. The depth to be used with the tables is taken to the top of the deck at side, whether of wood or steel, and summer freeboards are tabulated as in the German regulations. The committee recommend that the freeboards of British ships be marked from the deck at side instead of being set down from a statutory deck line in accordance with the Merchant Shipping Acts. A more logical method of assessing the value of erections which takes account of their extent, disposition and the nature of the closing appliances has been adopted. Fig. 8 shows the present British freeboards compared with the committee's proposed freeboards in the case of a 400-foot vessel

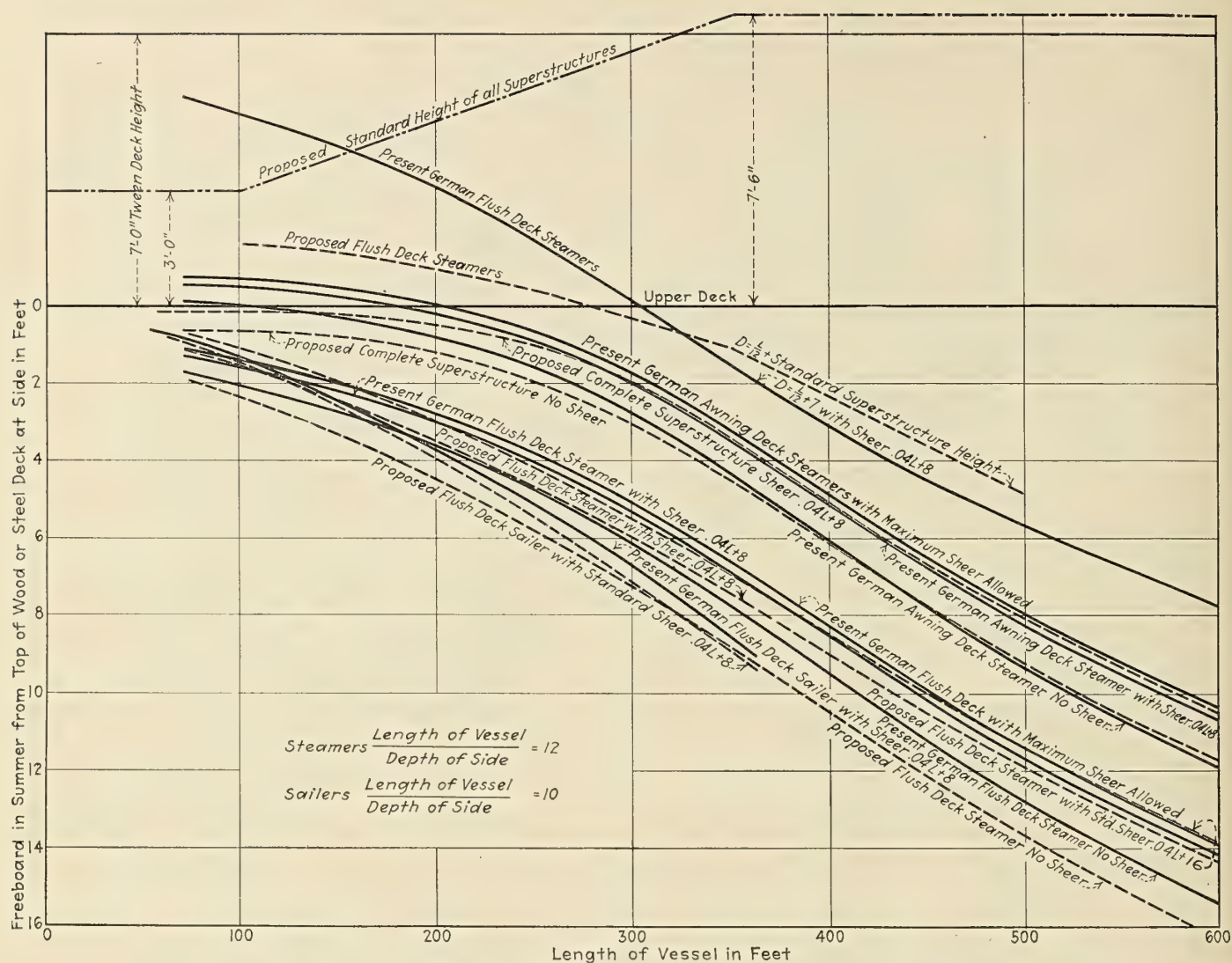


Fig. 7.—Comparison of 1915 Load Line Committee's Proposed Freeboards With Present German Freeboards

with different types of erections, varying proportions of $\frac{L}{D}$

and different mean sheers. The committee lays particular stress upon the necessity of providing adequate protection for openings, and instead of proposing to make additions to the freeboards of vessels on account of deficiencies in this respect conditions of assignment of freeboard are laid down with regard to the strength of machinery casings, hatches, ventilators, openings in the superstructures and in the sides, such as gangway doors, side ports, etc., which are an amplification of the present requirements.

Probably the most important part of the committee's work was the formulating of a new standard of strength to be used in association with the new freeboard rules. A technical staff was employed to carry out the necessary research work, and under the guidance of Professor Abell, of Liverpool University, now chief surveyor of Lloyd's Register, a very thorough analysis was made of ship structural practice as determined from the 1913 Rules of Lloyd's Register, British Corporation, Bureau Veritas and Germanischer Lloyd's, as it was considered that the classification rules, embodying as they do the results of years of experience, were good for a wide range of loading conditions. It was ultimately found possible to express by comparatively simple formulae the average minimum requirements of ordinary practice found from the above analysis.

The proposed standard of longitudinal strength is measured by the modulus of resistance of the midship section of

the vessel computed by the usual methods. The standard $\frac{I}{Y}$ is found from the formula:

$$\frac{I}{Y} = f \times b \times d,$$

where b is the breadth of the vessel, d the extreme summer draft and f is a longitudinal strength factor tabulated in terms of the vessel's length. The $\frac{I}{Y}$ through a section in

way of the midship deck openings must not be less than $.9 \times f \times b \times d$, so that provision is made for a definite standard of deck compensation abreast openings. Straight line formulae are given for determining the standard minimum thickness of side plating and the corresponding frame spacing for any length of vessel, together with a method for estimating the increase in shell thickness required for variations in frame spacing over the standard. As transverse strength is at least of equal importance to longitudinal strength it is gratifying to note that an endeavor has been made to lay down a minimum standard of strength for at least one of the transverse members of the hull structure, i. e., for hold framing, and that the proposed formula for the re-

quired $\frac{I}{Y}$ of the frame section takes account in some degree

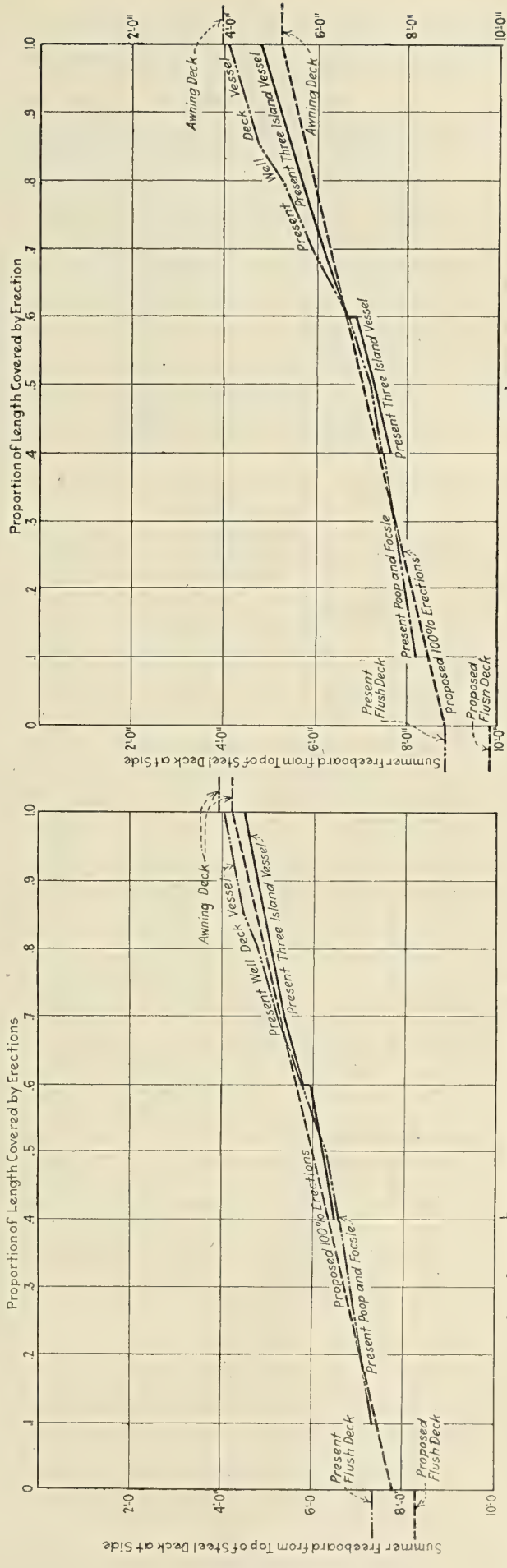
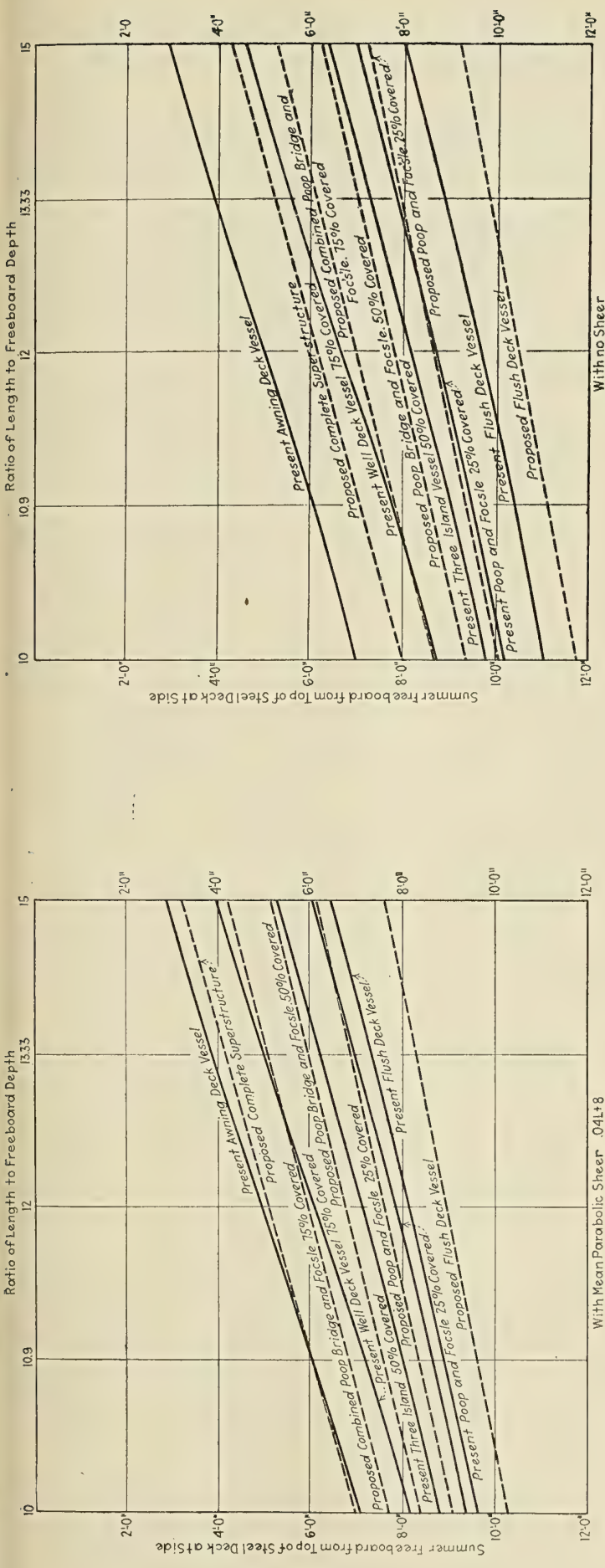


Fig. 8.—Comparison of Freeboards for 400-Foot Vessel With Varying Proportions of Length of Vessel Depth of Side

of the principal factors which should enter into the determination of the frame scantlings, i. e., length of unsupported frames, spacing of frames, load draft and height of deck loads.

While the proposed standard of strength is probably satisfactory enough as far as it goes it is anything but complete, as a ship could be designed to comply with the new standard and yet prove very unsatisfactory from a structural point of view. Provided its limitations are understood, the proposed standard of strength should prove distinctly useful to naval architects, but it cannot take the place of classification society rules, as nothing is said about riveting and such important considerations as the bottom framing and the thickness of deck plating in relation to beam spacing. While the size of the frames as derived from the standard is affected by the height of the bracket floors the size of the beam knees at the lowest tier of beams is not taken into account in determining the modulus of resistance required, and although the necessity of providing sufficient stiffness in the frame apart from

$\frac{I}{Y}$ value is emphasized the necessary modifications to

scantlings on this account are left to the assigning authorities. As the strength standards laid down are for vessels built on the ordinary transverse system, their application to longitudinally framed ships will also necessarily be left to the assigning authorities. No reference is made in the report to wooden or composite vessels, and this omission may have to be remedied in any international rules in view of the considerable amount of wooden tonnage still in existence.

The proposals of the 1913-15 load line committee undoubtedly represent a distinct advance over existing freeboard regulations. While there may be differences of opinion with regard to the theoretical basis of the strength standard, there is no question about the advantage possessed by the proposed rules over those at present in force in respect to the simplicity of arrangement, lack of ambiguity and ease in the actual working out of the freeboard and strength calculations. Since there can be no finality in freeboard rules any more than in rules for ship construction, it is also a distinct advantage that the proposed rules are in a form in which they can be readily amended if and when alterations are considered advisable. The proposed new regulations will mean that freeboards will be increased for practically all vessels where the openings in the terminal bulkheads of erections are not closed by class 1 appliances, and considerable increase in freeboards will result in the case of flush deck vessels, especially if the sheer is less than the new standard. The rules are a step in the right direction in respect to the emphasis placed on structural strength and conditions of assignment as to protection of openings which, however, can be easily and cheaply carried out in new construction. Since the publication in 1916 of the British load line committee's report sufficient time has elapsed to give the various freeboard authorities opportunity to compare the new proposals with existing freeboard regulations, and it is quite possible that the British authorities, in the light of their further experience, may now desire to make changes from the proposals of the load line committee.

This country is not handicapped by precedent in the matter of freeboard or load line legislation, so that the work of the American load line committee, of which Admiral Taylor is chairman and which is at present considering the entire subject, is of the highest importance. In this connection, although it has not been found possible within the limits of this paper to deal with other than the freeboards of ordinary seagoing freighters, it might be remarked that there are particular types of vessels which constitute a special problem for this country and which are being investigated by the several sub-committees formed for the Atlantic and Gulf coasts,

Pacific coast and Great Lakes districts under the direction of Professors McDermott, Durand and Sadler with a view to making recommendations to the Secretary of Commerce.

RanD System for Bunker Oil

MEANS for reliquidizing oil in ships' inner bottoms without the use of heating coils are provided by the RanD system for bunker oil recently placed on the market by Row and Davis, Engineers, Inc., 90 West street, New York. This system applies forced circulation to the bunker oil by means of a central heater located in the boiler or engine room connected to a circulating pump (usually the transfer pump) and with discharge and suction connections at the deep tank and inner bottoms.

Each hot oil discharge connection consists of a nozzle constructed so as to rotate slowly in a horizontal plane, thereby causing agitation in every direction throughout the mass of cold oil in the tank compartment. These nozzles are installed through an opening cut in the tank top and in the case of vessels already built this can be done and the entire system installed without removal of oil from the inner bottom tanks. The deep tank connection is used to start the system and where the vessel is not fitted with a deep tank or settling tank a specially designed bulkhead connection is furnished to provide an auxiliary for temporary use in starting.

With this system an inner bottom tank 90 feet long has been handled with two discharge nozzles, one at each end of the tank. The exact number and location of the nozzles as well as the determination of the capacity and arrangement of the system are matters of special engineering for each installation and are decided after a thorough investigation of the plans and fuel requirements of the vessel considered.

The principal advantages claimed for the RanD system are as follows:

1. Circulation and effective reliquidizing of the oil are assured by the constant inflow of hot oil through the rotating nozzles and the constant withdrawal of cold oil to the heater.
2. The temperature of the oil can be positively controlled either manually or thermostatically, so as to prevent overheating and partial destructive distillation with loss in fuel value of the oil.
3. The system provides a flexible control of the oil temperature to meet changing conditions of sea water, weather, or grade of oil used. The circulation can be increased or decreased by changing the pressure of the oil at the nozzles and the temperature of the oil can be increased or decreased by changing the steam pressure in the heater.
4. A uniform temperature is maintained throughout each tank compartment, preventing any strata of congealed oil from diminishing the effective tank capacity.
5. There are no heating coils or other equipment in the tank compartments to reduce tank capacity, contaminate oil through leakage, increase maintenance cost through rapid wear and difficulty of repair, or overheat the oil.
6. The entire system (except the discharge nozzles) is outside of the tank compartment, in plain view, and readily accessible.
7. The system makes use of existing pipe connections and pump and can be installed at comparatively small cost and without removing oil from the ship's inner bottom. Repairs and replacements are normally few and readily made.
8. There need be no guesswork as to elements of design or arrangement of the system, because the circulation of oil which it produces is known to be positive and governed by definite calculations.

VESSELS DELIVERED BY GERMANY.—The total tonnage of vessels delivered by the Germans up to December 31, 1920, was 2,054,729 tons gross. The proportion representing sailing vessels was 25,325 tons. The amount of tonnage yet to be delivered is about 500,000. The Reparations Committee has delivered 1,814,173 tons as follows: To Great Britain, 1,477,839 tons; to France, 166,924 tons; to Italy, 124,901 tons; to Japan, 28,678 tons, and to Belgium, 15,831 tons.

Problem of the Hull and Its Screw Propeller*

Selection of Data for Hull and Propeller Design—Method of Making Corrections for Variations in Hulls—Appendage Resistance

BY REAR-ADMIRAL C. W. DYSON, U. S. N.

IN 1915 Sir Archibald Denny made the statement that in the future the rules for the correct designing of propellers should be derived from data carefully taken from the trials of smooth bottom vessels carefully run over accurately measured deep water courses.

Several years ago Admiral Taylor wrote to the effect that if theoretical formulas for design are adhered to it would be necessary to compare each formula with experimental results and select that one which seemed to agree more closely. Then, using this as a semi-empirical formula with constants deduced from experiments or experience, problems could be satisfactorily dealt with.

Both of these statements practically agree. Denny boldly casts all theoretical treatment of the propeller into the discard, while Taylor, by implication, takes the same action, only retaining enough of the theory to save its face, to use a Chinese expression.

To accept these statements of such eminent authorities at their full value throws us at once into the field of empirical results from which to derive data and formulas for the determination of hull forms and characteristics of propellers to fit any particular form of hull and the resistance which it may be desired to overcome.

DIFFICULTIES ENCOUNTERED IN OBTAINING RELIABLE DATA

Upon entering the empirical field for propeller data the investigator is at first encouraged by the large, apparently large, amount of data available, but it does not require any extravagant amount of time for him to ascertain that fully 95 percent of the available data is absolutely worthless, this statement of course referring to conditions where general formulas and constants for design covering the entire field of the combined problem, ships and their propellers, are being sought.

The principal causes of worthless data are:

- (a) Lack of model tank trial curves for the ship.
- (b) Variations in conditions of ship's bottom.
- (c) Deep sea trials in place of measured mile.
- (d) Variation in displacement and trim from those of model.
- (e) Measured mile trials run in a tideway with insufficient number of runs for each spot.
- (f) Trials run in shallow water.
- (g) Model hull, when tried, not fitted with external appendages.

All of the above relate to the hull and the responsibility for them rests with the owner, the builder and the naval architect, all of whom, apparently, are so short sighted as to be able to see only the few dollars saved today by comparatively petty economies, losing sight entirely of the thousands of dollars which would be realized in the future were the small trial savings of today ignored.

Turning now to the propellers we find:

- (h) Blade forms varying according to the taste of the designing engineer.
- (i) Blade sections varying to the same degree as blade forms.
- (j) Variations of pitch in a blade and in the blades of the same propeller.

- (k) Blades abnormally thick and blunt.
- (l) Blades exceedingly rough.
- (m) Blades made with pitch expanding radially or axially, or both.
- (n) Hub of such form as to cause abnormal eddy losses.
- (o) Propellers so located with respect to the hull of the ship as to produce abnormal losses.

The guilt for all of these rests with the designer of the propeller. The naval architect is, however, *particeps criminis* in the last named offense.

DERIVATION OF FINENESS OF AFTER BODY OF THE SHIP

In making the selection of data upon which to base formulas and design data it is necessary to confine consideration to hulls of fine lines with propellers so placed that the chances of decrease in propulsive efficiency due to hull effect are reduced to a minimum. The propellers which are fitted to these hulls must all have practically the same radial distribution of the projected areas, must have the same general forms of blade sections, must be true to pitch, fine-edged and smooth, in order to eliminate as many variables as possible from the equations.

VARIATIONS IN HULLS OF VESSELS

Suppose a vessel to have a certain set of forward and of after body lines with a parallel middle body of a certain percentage of length of the vessel. She will have a certain block coefficient. Now, maintain the same forward and after body lines, but modify the length of the middle body. As the length of the middle body increases over the initial length the block coefficient increases, and vice versa; but the after body lines, which control the character and quality of the flow of water to the propeller, have remained as at first. It is impossible, therefore, to base propeller conditions on block coefficient, but there must be provided a means of bringing measurements of block coefficient to a standard condition.

In the foregoing example the constants, in addition to the forward and after lines, are the beam B and the draft H , while the ratio $B \div L.L.W.L.$, or $B \div L.B.P.$, is variable.

Having obtained a means of correcting for the variable there will immediately be discovered another condition which contains the same variable as before, but, in addition, H has become variable. Experience has taught that with constant form and area of load waterplane, to decrease the draft of the hull is to increase the nominal block coefficient, but the wake will not increase but will remain practically the same as with the initial draft; while should the draft be increased the nominal block coefficient will be decreased, but, as in the opposite case, the wake will remain practically unchanged.

Having corrected for varying ratios of length to beam and of draft to beam, it might be considered that the coast has been cleared and that a position had been reached where the propeller could be taken up, but this is not the case. There is still a variable, and that a very important one, to take care of, namely, varying ratios of lengths of after body, or, if preferred to so call it, length of run to draft. This variable has a very strong effect on the wake, varying both the character and the quality of the flow of water to the propeller.

All of the varying dimensions now having been covered, it will be found that still another correction must be made, and that is the correction for type of hull. The types of hulls are sharply defined by the character of the after body lines as

* Paper read before the Society of Naval Architects and Marine Engineers, New York, November, 1920.

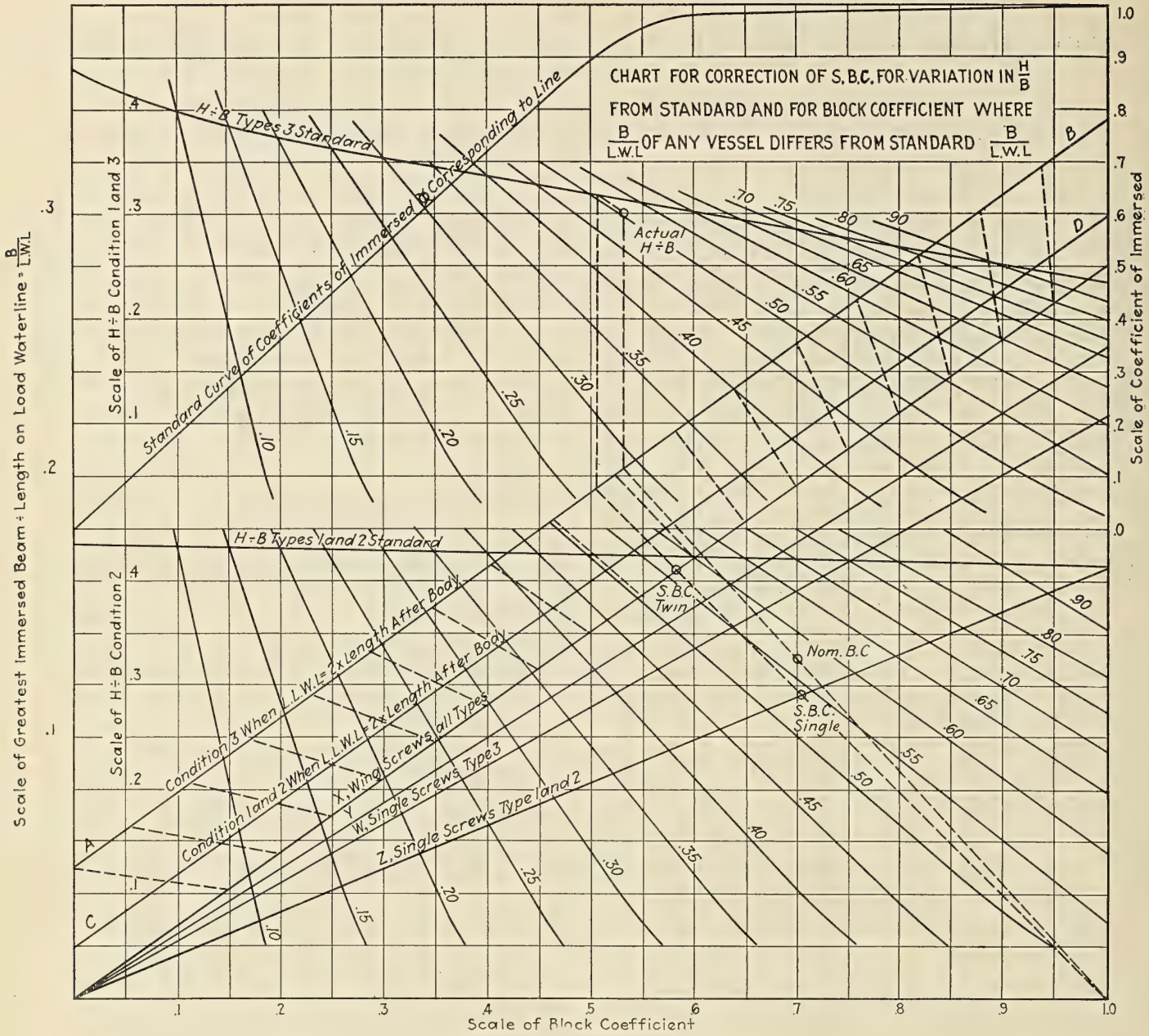


Fig. 1

the hull fines towards the stern, whether this fining is produced by a rapid dead rise of the bottom, with a very slow decrease in beam at the load waterline, or whether it is produced by a rapid decrease in beam. The latter type can be subdivided into two types, the first having a full and the second a fine midship section, the first tending to concave body section lines and the second to convex. In the first subtype the propellers are to a great extent, or entirely, covered by the submerged hull, while in the second subtype the propeller may be entirely outside the limits of the load waterplane. The first subtype will be spoken of here as Hulls of Type 1, and those of the second subtype as Hulls of Type 3.

Where the hull fines rapidly by means of a rapid rise of the bottom towards the stern the vessel is denoted as having a Hull of Type 2.

As examples of the different types the following may be taken:

- Type 1—United States dreadnoughts and destroyers.
- Type 2—Vessels of the ordinary fantail form of stern such as United States colliers and the ordinary type of merchant ship, also submarines.
- Type 3—Vessels having the so-called cruiser stern; gun-

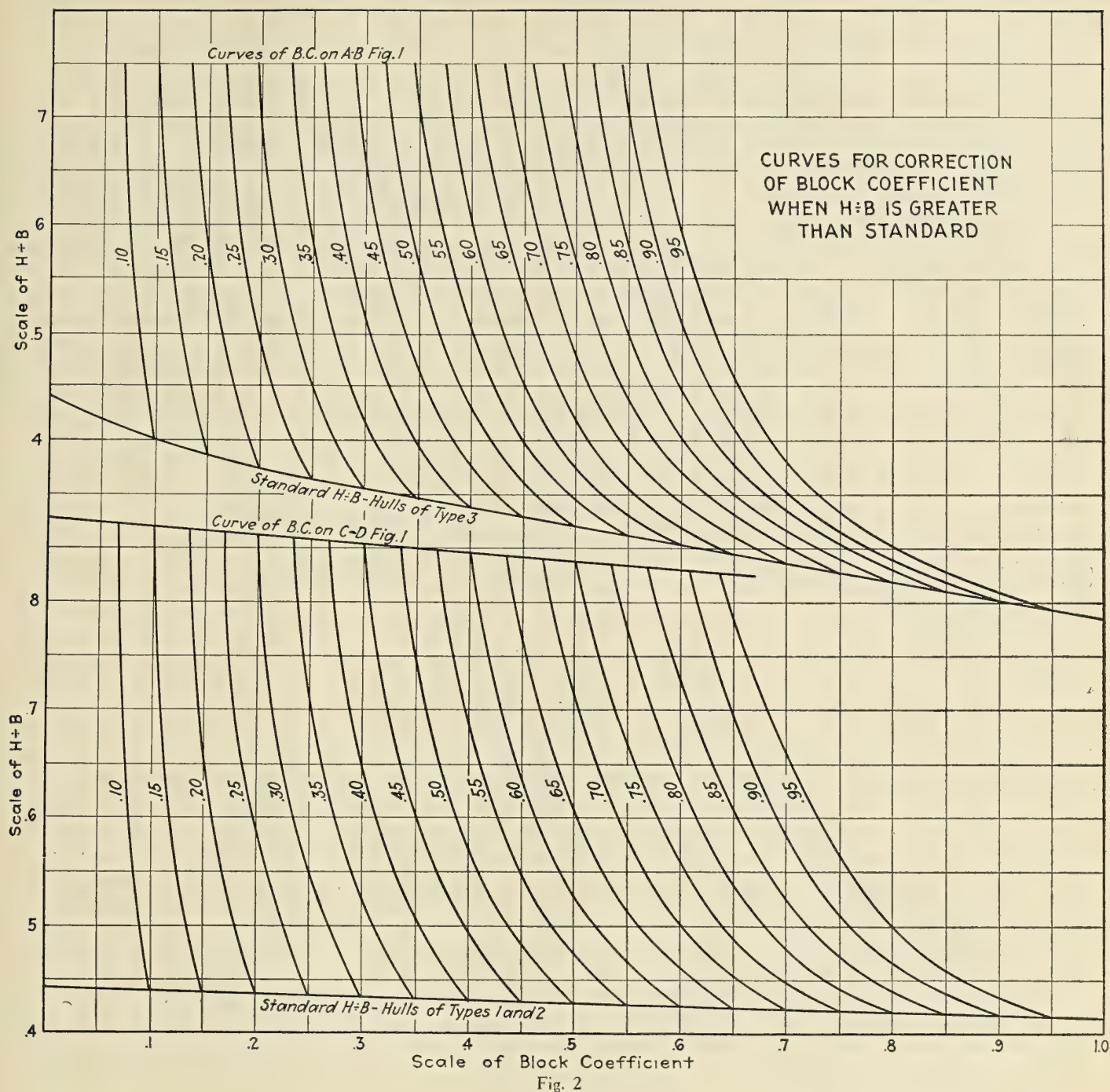
boats *Annapolis* and *Sacramento*, battleships of the *Virginia* class, battle cruisers, scouts.

METHOD OF MAKING HULL CORRECTIONS

The determination of after body form or, as it may be expressed, the determination of the slip block coefficient of a ship, together with the effect of the variations of ratios of length, beam and draft, can be expressed graphically. With the exception of the correction for ratio of length of after body to draft, which correction is used rather for the correction of apparent slip rather than of slip block coefficient, the preliminary estimate of this coefficient, together with its correction for ratio of draft to beam and of length on load waterline to beam, for all the various hull conditions which may be considered as of normal form, are shown on Figs. 1 and 2.

On Fig. 1 the line X passes through the points whose abscissas are nominal block coefficients, while the ordinates are the ratios $B \div L.L.W.L.$. The value $L.L.W.L.$ may be replaced by $L.B.P.$ (length between perpendiculars) without any sensible error, as the entire method must be considered as one of approximation.

For the vessels of types 1 and 2 there is given a curve of



coefficient of midship section, at the top of Fig. 1, for the block coefficients as given by the intersection of the diagonal through the plotted point of nominal block coefficient and the abscissa value 1 with line X. Where the coefficient of midship section for any block coefficient referred to line X is less than the standard for this referred block coefficient as given in Fig. 1 the after body form approaches the form for type 3.

CORRECTION FOR $B \div L.L.W.L.$

Of the standard hulls chosen on which to base the chart, those of type 3 had short middle bodies which, when eliminated, would have raised the ratio line of $B \div L.L.W.L.$ to AB, while those of types 1 and 2 would have raised this ratio line to CD, the nominal block coefficients decreasing in both cases. Now let it be supposed that the forward and after bodies remain constant but that the length of the middle bodies be varied. As this length increases the nominal block coefficient will increase until at length the effect of the fineness of the forward and after bodies on the value of the nominal block coefficients will become inappreciable so that the nominal

block coefficient as calculated will be unity. On the other hand, the middle body may be entirely eliminated when the nominal block coefficient will be that of the combined fore and after bodies only. These changes of nominal block coefficient will take place approximately along straight lines passing through the plotted point of nominal block coefficient and the point of 1.0 on the scale of abscissas where the ordinate $B \div L.L.W.L.$ is zero. The equation to these lines is:

Nominal block coefficient on

$$X = \frac{B \div L.L.W.L.}{.28 (1 - \text{Nom. B.C.}) + (B \div L.L.W.L.)}$$

Now the line X is for slip block coefficients of standard twin screw ships of all the types and the standard block coefficient for single screw ships of type 3 would be that where the line through the plotted position of the actual ship crosses the line W, while for type 2 and type 1 it would be at the point of crossing of the line Z.

Should the vessel have four shafts, for vessels of standard

ratios of $H \div B$ and $2L.A.B. \div H$, the slip block coefficient for the outboard propellers will be the intersection of the correction line with the line X and for the inner propellers the intersection with the line Y . Should the ratio $2L.A.B. \div H$ be much greater than the standard, the above corrections will be reversed. As it takes quite a large variation in slip block coefficient to make a heavy variation in revolutions, this correction for position may be neglected without serious error and the point on X only be considered.

CORRECTION FOR VARIATIONS IN $H \div B$

The ratios $H \div B$ for type 3 ships, corresponding to the nominal block coefficients as given by line AB , are given by the curves on Figs. 1 and 2, marked $H \div B$, type 3 standard, while those for types 1 and 2 vessels are given by the curves on the same figures marked $H \div B$, type 2 standard. There will be noted diagonal curved lines extending from above at the left to below at the right of the figures, marked with the

Vessel B

Nominal $B.C.$	$=$	.7
$B \div L.L.W.L.$	$=$	.13
$H \div B$	$=$	.5
$2L.A.B. \div H$	$=$	13.5
Coefficient of midship section	$=$	.98

Examination of the after body lines discloses that these lines fine rapidly due to a rapid decrease in draft of the actual full body of the hull, the beam being decreased very slowly as the stern is approached, while the screw is completely covered by the hull in the case of twin screws. These conditions, in conjunction with any value of $H \div B$ indicate a hull of type 2.

VESSEL A, TYPE 3

Plotting vessel A on Fig. 1 with a nominal block coefficient of .632 and a value of $B \div L.L.W.L. = .16$, and drawing a line through this plotted point and the point on the base line where $B.C. = 1.0$, this line is found to cross the line AB

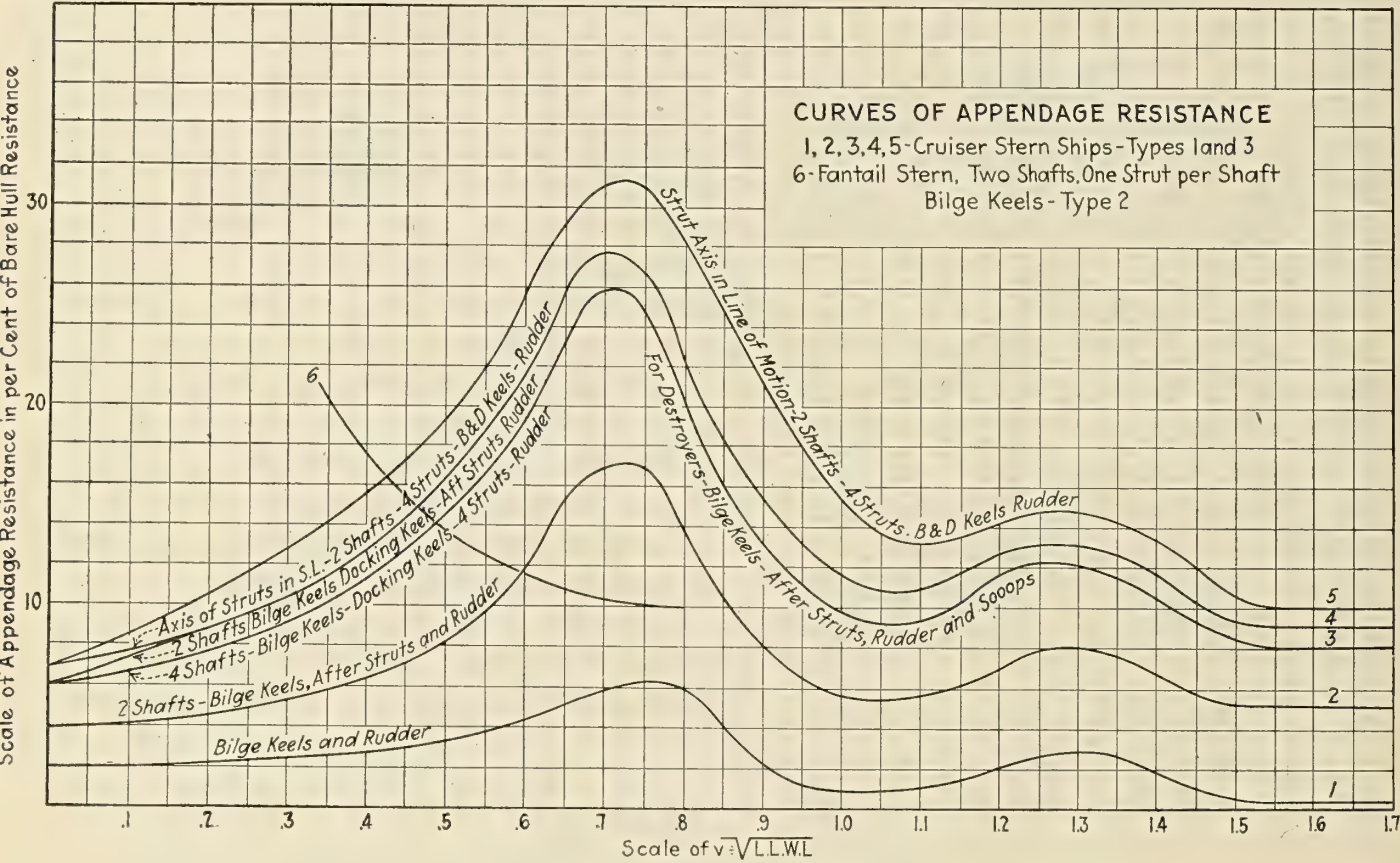


Fig. 3

values of the nominal block coefficients as taken from line AB for type 3 and from CD for types 1 and 2. These are direction lines to follow in correcting for values of $H \div B$ less than standard on Fig. 1 and for greater than standard on Fig. 2.

EXAMPLE ILLUSTRATING THE ABOVE METHOD OF ESTIMATING THE SLIP BLOCK COEFFICIENT OF A VESSEL

To illustrate the above, two vessels will be taken:

Vessel A

Nominal $B.C.$	$=$	.632
$B \div L.L.W.L.$	$=$	.16
$H \div B$	$=$	.3
$2L.A.B. \div H$	$=$	14.66
Coefficient of midship section	$=$	.930

Examination of the after body lines discloses that these lines fine rapidly due to a rapid falling away in beam and are convex. This indicates that the hull is of type 3 form.

at $B.C. = .535$. Erecting an ordinate from this point on AB to the value of $H \div B = .3$ below the curve $H \div B$, type 3 standard, and following the direction lines up to this curve, the corrected $B.C.$ on AB is found to be .505. Through this point .505 on AB draw another line through the base at 1.0. Where this line crosses X , which is at an abscissa value of .585, will be the corresponding corrected value of the $B.C.$ for wing screws, while where it crosses W , at .64, will be the $S.B.C.$ for a single screw vessel or for the center propeller of a multiple shaft vessel with an odd number of shafts.

Should the vessel be fitted with wing propellers a correction should be made for variation of midship section coefficient from standard by multiplying the value of the $S.B.C.$, line X , by the ratio actual midship section coefficient $\div$ standard coefficient.

VESSEL B, TYPE 2

Turning now to vessel B, passing the line through its plotted point, nominal $B.C. = .7$, $B \div L.L.W.L. = .13$, and

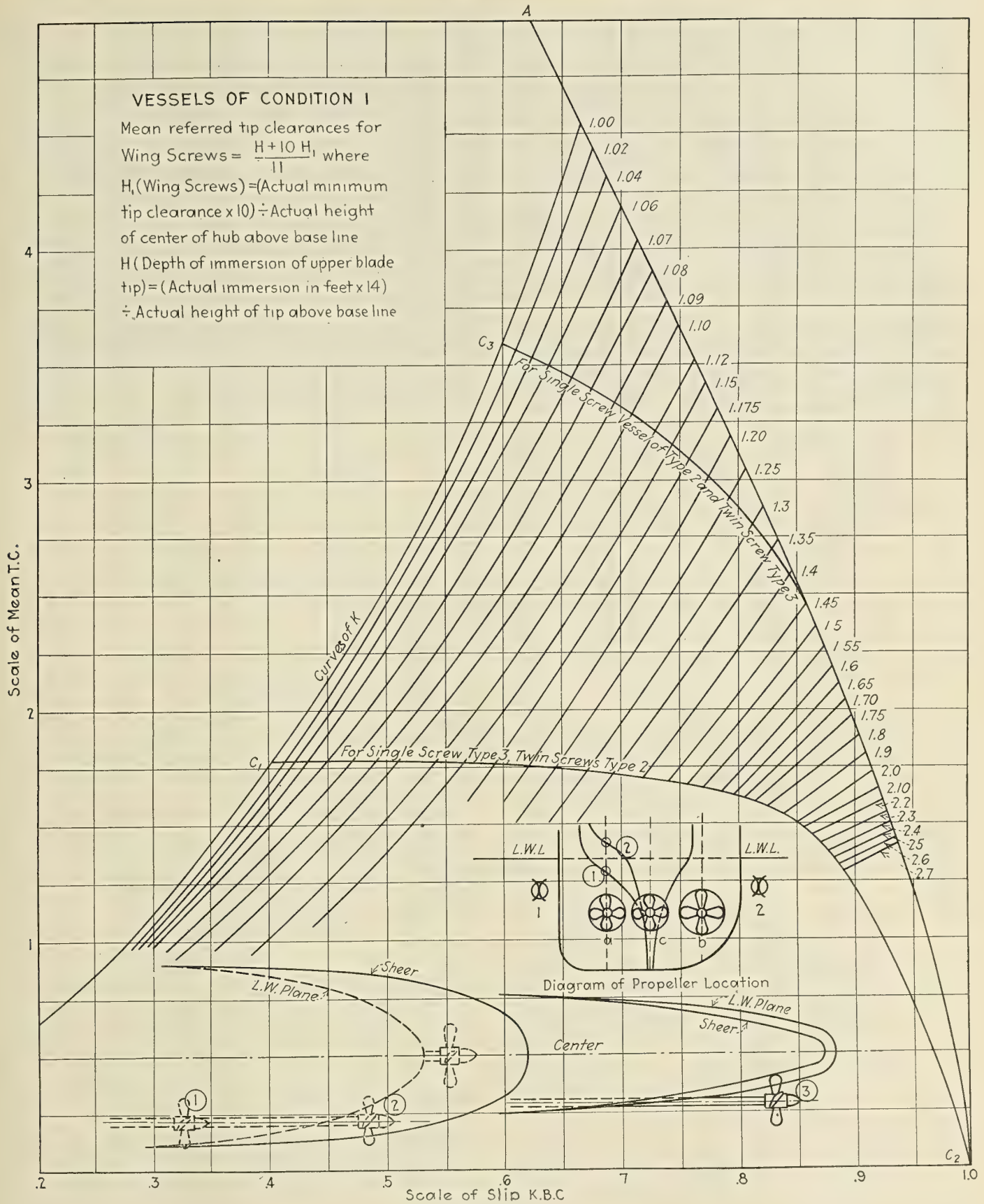


Fig. 4

abscissa value 1.0, and extending the line to *CD* it will be found to cross this line at the *B.C.* value of .582. On the curve marked *H ÷ B*, condition 2 standard, the value of *H ÷ B* is found to be .423; therefore, the actual value of *H ÷ B* being greater than this standard, turn to Fig. 2 and plot the point *H ÷ B* = .5, *B.C.* = .582 above the lower standard *H ÷ B* curve, and from this plotted point follow

the curves of direction down to this standard line. It will intersect this line at *B.C.* = .675. Through *B.C.* = .675 on *CD* and abscissa unity again draw a line. Where it intersects *X*, at *B.C.* = .697, will be the *S.B.C.* for twin propellers, while where it intersects *Z*, at .797, will be the *S.B.C.* for a single screw ship, that is a vessel with a single propeller on the centerline of the hull.

VESSEL C, TYPE 1

In vessels of type 1 the determination of *S.B.C.* is made as for type 2.

With vessels of this type the character of the wake appears to be nearly similar to that for type 2, while quality is more nearly like that of type 3.

By character of wake is meant the degree of obliquity of flow of the water to the propeller disk, while by quality of wake is designated the degree of disturbance of the wake and general decrease in its density due to contained air in the water in which the propeller operates.

Conditions of wake are the most favorable with ships of type 1, less so with ships of type 3, and decidedly unfavorable with ships of type 2, although it may be claimed that vessels of this latter type carry much heavier wakes than do the other types and more gain should therefore be realized from the wake than with the other two types. This claim would be a just one were the quality of the wake with the vessels of this type with which designers ordinarily have to deal equal to that experienced with vessels of the other types.

It has been attempted in the foregoing to give a slight idea of the difficulties in arriving at the very foundation of the screw propeller problem before the propeller can even be approached. It is hoped that it has also shown the absurdity of basing any propeller design upon nominal block coefficient without correction. In connection with this the author had the rather amusing experience of being approached by a gentleman with the question as to how he "would determine the slip block coefficient of a vessel to use by looking at her in the dry dock." The same gentleman also made the statement that he was able to determine by inspection the proper diameter and pitch of propeller for any given hull.

It will now be necessary to say a few words concerning the resistance to be overcome by the propeller in driving the hull through the water.

RESISTANCE—HULL AND APPENDAGES

The question of hull resistances being so fully understood, it is only necessary to state that for propeller work, in developing a system for design purposes, only such vessels should be used as have had their resistances determined by towing the model of the hull in a model basin.

It does not suffice to tow the model of the bare hull, but this model should be fitted with all external submerged attachments in order that the true resistance of the hull may be arrived at.

Fig. 3 shows curves of appendage resistance in percentage of bare hull resistance, erected on values of speed of vessel $\div \sqrt{L.L.W.L.}$ as prepared by the writer from the reports of trials of models in the model tank at Washington. These curves are rough approximations, as the actual appendage resistance varies with the form of hull and the amount of power carried by the hull and also with the revolutions at which the propellers are to run, these latter two factors fixing the size of shafting, external lengths of shafting and size of propeller struts.

PROPULSION LOSSES DUE TO TYPE OF HULL AND TO
LOCATION OF PROPELLER IN RESPECT TO THE HULL—
THE POWER AUGMENT FACTOR *K*

It is a little premature to speak of these losses at this stage of the investigation as they really cannot be studied until the primary design curves have been arrived at, and this result can only be reached by selecting for the early investigations such vessels as, from the high values of the propulsive coefficients obtained, are decided upon as having all such losses reduced to the smallest possible minimum.

The losses, other than those due to poor workmanship in the propeller itself, arise from the reduction in pressure in the area in which the propeller operates and also from the

obliquity of flow of water to the propeller caused by the fullness of lines of the hull interfering with the flow. There may also be serious losses due to eddying around improperly formed stern and rudder posts, around struts of improper section and arrangement, around and between strut bosses and propeller hubs, around the hub itself and to excessive roughness of surface of the propeller blades and excessive variation of pitch between different blades of the propeller or throughout each blade. Of course these latter named losses are due to poor workmanship and can easily be avoided by care in casting, finishing and setting the propeller blades.

The loss factor or power augment is given the letter *K* to denote it. In previous works of the author this letter *K* has been spoken of as the thrust deduction factor, but this does not convey all that *K* represents, which, in fact, are the losses which have just been given.

The *K* factor has the minimum values for hulls of type 1, but these values for this type increase very rapidly as the tip clearance diminishes after a certain limit of tip clearance between the hull and the circumference of the propeller disk has been reached; this distance, so far as the author can determine, being dependent upon the draft of the vessel and the height of this minimum distance above the base line. The formula for obtaining this mean tip clearance is expressed by

$$M.T.C. = \frac{H + 10H^1}{11} \text{ where } H^1 \text{ (wing screws)} = (\text{actual}$$

tip clearance $\times 10$) $\div$ (actual height of hub center above base line) and $H =$ (actual immersion of upper blade tip in feet $\times 14$) $\div$ (actual height of tip above base line in feet).

Hulls of type 3 stand next in order of loss, while those of type 2 are the heaviest losers, single screw ships of type 3 having the same loss factor as twin screw ships of type 2.

The values of *K* for the different classes of hulls are shown on Fig. 4, the ordinates being mean referred tip clearances for type 1, while the abscissa values are values of *K* block coefficient, *K.B.C.*, which are obtained from Fig. 1 by taking the intersection of the line through the plotted point nominal *B.C.* — $B \div L.L.W.L.$ and the abscissa point of unity with *X*, *W* or *Z*, according to whether the vessel is a wing or single screw ship. The block coefficient value of this intersection is the *K.B.C.* for the vessel. The values given by Fig. 4 hold very closely for all vessels of what may be considered normal dimensions. For vessels having extremely great ratios of length of after body to draft they may possibly decrease to some extent, but there are no data of sufficient accuracy to enable this to be stated definitely.

(To be continued.)

THE SHIPBUILDING CAPACITY OF GERMANY.—Herr Phillip Heineken, the retiring chief of the North German Lloyd, in an article to the Norddeutscher Lloyd Year Book, stated that for the next few years the amount of building of new vessels by Germany for her own requirements will not be worth mentioning. He says that the 1913 output of German shipyards amounted to over 500,000 tons per annum, but other estimates state that the output now can be increased to 7,800,000 tons, in view of the erection of new yards during the war and the conversion of naval yards to construction for mercantile purposes, so that, even after deducting the 200,000 tons per annum to be built for the Entente during each of the next five years, a resulting increase in the output of German tonnage may be expected. Herr Heineken considers these figures to be exaggerated and points out that the factors which counteract such optimistic views are scarcity of coal and ores, excessive rise in wages and general working costs. Many years will pass before German shipyards will be able to cover, even approximately its own requirements, and until they are in a position to do so they cannot avoid leaning upon foreign shipping companies to a certain extent.

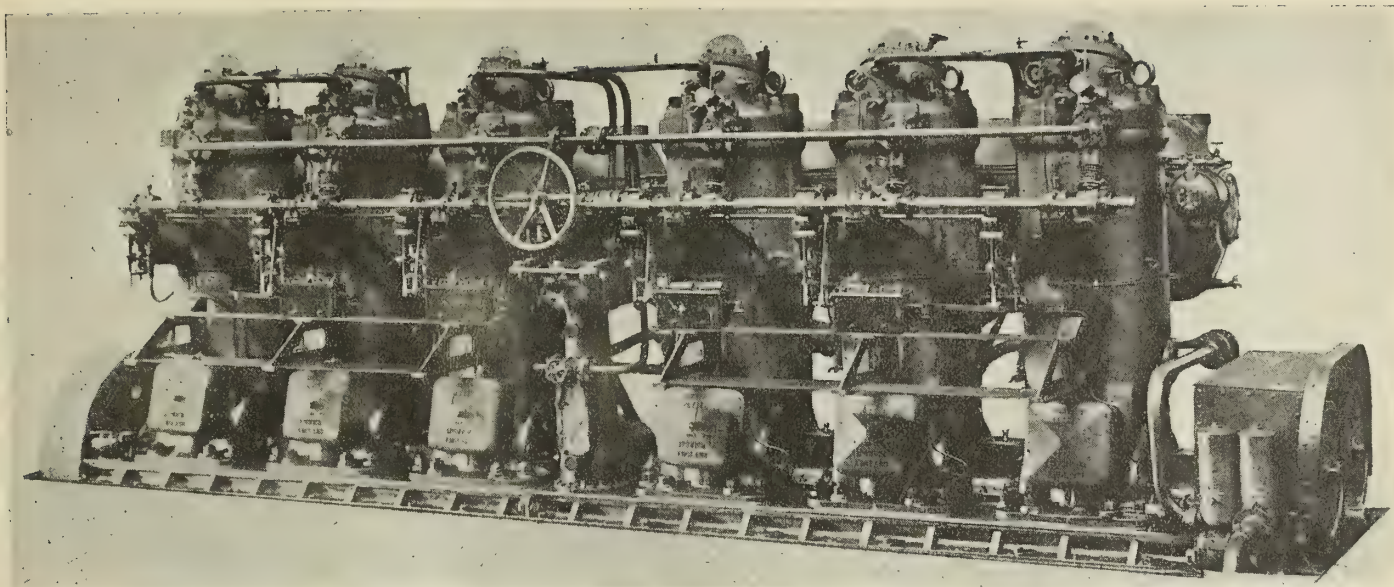


Fig. 1.—Vickers-Petters Semi-Diesel Engine, 500 Horsepower

Two Versus Four Cycle Diesel Engines

Competition Between Manufacturers of the Two Types in Europe Becomes Lively—Fast Cross-Channel Motorship Proposed

BY OUR SPECIAL LONDON CORRESPONDENT

SIGNS are not wanting that the struggle which was bound, sooner or later, to occur between manufacturers of the two cycle and four cycle types of Diesel engine, is about to commence in earnest. One of the most significant facts in this connection is that many of the large shipbuilding concerns in the United Kingdom which are mainly engaged upon the construction of high powered vessels, such as passenger liners, have decided to adopt the two stroke type. For instance, in this category come John Brown and Company, William Denny and Brothers, Alexander Stephen and Company on the Clyde, and Armstrong Whitworth, Wallsend Slipway and Engineering Company, Swan, Hunter and Wigham Richardson and Doxfords on the North East Coast, in addition to Cammell Laird of Birkenhead. Dennys, Armstrongs, Cammell Laird, Stephens, and Swan Hunters are all now finishing their first motorships equipped with two cycle machinery and before the end of the year it is anticipated that detailed figures will be published showing the advantages which the manufacturers of this type claim for it in comparison with four cycle machinery.

PORT SCAVENGING TWO CYCLE ENGINES

A point upon which great stress is being laid at the present time is that two cycle Diesel engines fitted with port scavenging can utilize any grade of oil available, even that which is commonly burned under boilers, whereas four cycle machines must necessarily have a lighter and more expensive fuel on account of other difficulties which may otherwise be encountered with the exhaust valves. This is a matter of extreme importance, for the shipowner whose vessel is equipped with a motor capable of consuming any available oil is clearly at an advantage. Recent tests show that the new Doxford engines run extremely well on Mexican fuel oil with a consumption of about 0.43 pound per brake horsepower hour while similar trials on Sulzer two stroke engines give a consumption very little higher. If these results can be confirmed in actual service at sea, it can scarcely be ques-

tioned that the popularity of the two cycle engine will increase by leaps and bounds.

There are some remarkable projects afoot in connection with the installation of two stroke engines in large vessels. It will not be long before the first large transatlantic passenger liner is ordered by one of the best known British ship-owning firms which is holding the matter up on account of the general belief that shipbuilding prices will have to fall to a considerable extent in the next month or two. For the same reason the 16,000 horsepower motor passenger liner for the Swedish-American Line will not be laid down for a few months.

A 25-KNOT CROSS-CHANNEL MOTOR MAILBOAT

Another and extremely interesting order which will be placed at no distant date is for a cross-Channel passenger and mail boat with a speed of about 25 knots. Hitherto these vessels (for service between England and France) have been mainly equipped with steam turbines but it is considered that even in Europe, where the price of oil is high compared with coal, a motor vessel of this type will prove more economical than the steamer. The power required is 10,000 brake horsepower and it is proposed to use two high speed submarine Diesel engines of the Sulzer type. Engines of this design developing 4,000 brake horsepower have recently been built for the Japanese Navy and there is nothing at all experimental in their construction. They have six cylinders and run at 350 revolutions per minute and it is estimated that the weight and space occupied with Diesel machinery in a cross-Channel boat will be considerably less than when geared steam turbines are adopted.

In an ordinary ship no engineer would recommend the installation of high speed Diesel engines but in cross-Channel boats where the machinery is operated only perhaps three or four hours daily and where constant attention can be given, there seems to be no reason why they should not prove entirely successful. A feature of this plant will be the adop-

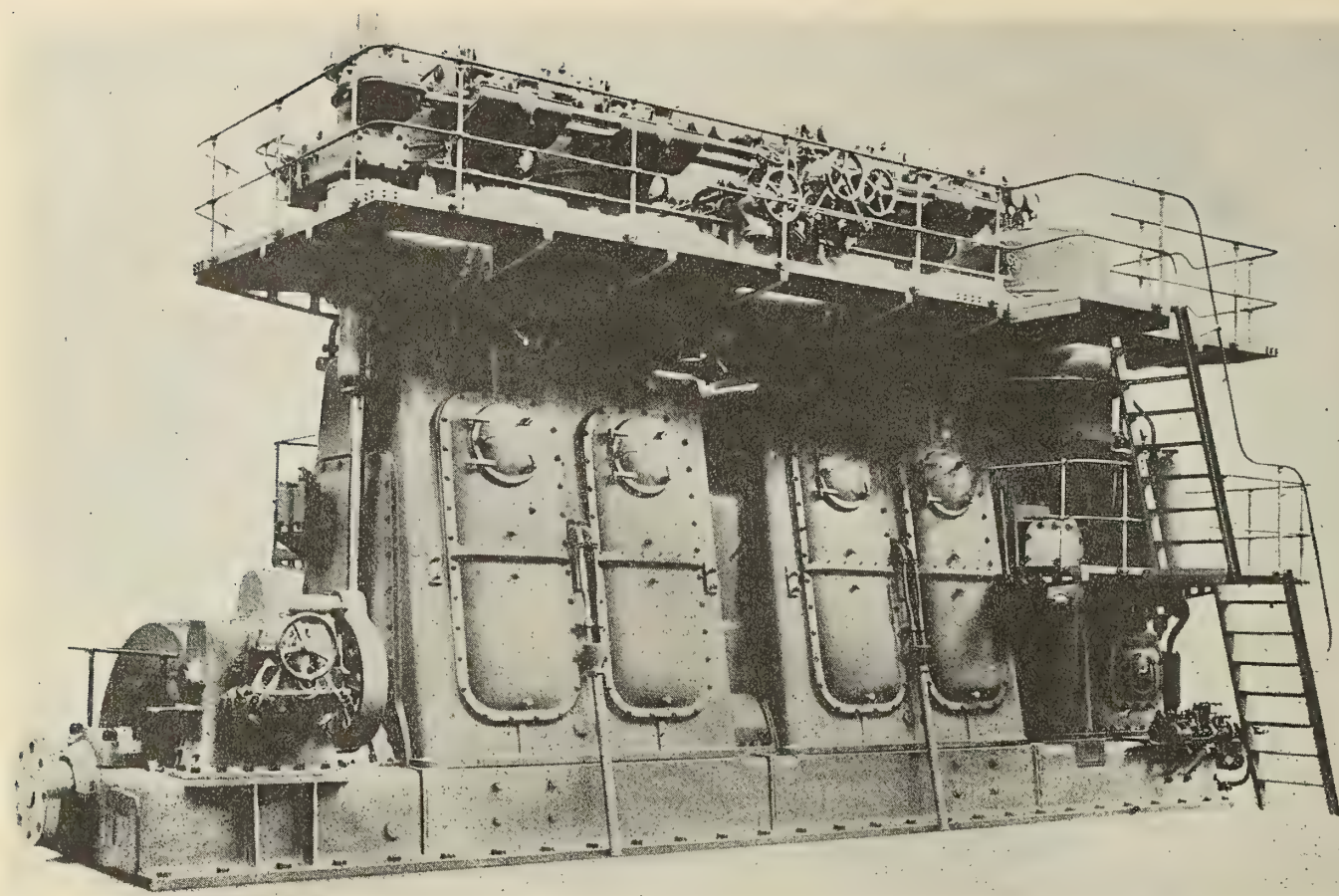


Fig. 2.—Two-Cycle Sulzer Marine Engine, 1,250 Horsepower

tion of turbo scavenging pumps driven by electric motors, this being a system which Sulzers have standardized for all high powered sets. The scavenging air is then supplied separately and the volume and pressure are independent of the speed of the engine while it can be warmed when starting up. According to recent tests the consumption of power for the auxiliaries including the scavenging pump and the air compressors is just over 10 percent of the engine output.

13,000-TON STANDARD MOTORSHIPS

Depression in the shipbuilding industry and the cancellation of orders are having comparatively little effect upon motorship developments. No orders for internal combustion engined craft have been countermanded nor is work being held up since the shipowners are far-sighted enough to see that in times of slumps it is the motorship which is the better profit earning proposition. The East Asiatic Company, the pioneer motorship owning firm, is proceeding as rapidly as ever possible to build up its fleet of oil engined vessels on a larger scale than any other European concern. Two more 13,000-ton ships (sister vessels to the *Afrika*) have just been launched in Denmark, named the *Malaya* and the *Java*; both are for the East Asiatic Company. Previously, practically all the East Asiatic Company's contracts were placed with Burmeister and Wain but this firm has so many motorships on order that the East Asiatic Company was forced to place its orders elsewhere and the *Malaya* was therefore built at the Nakskov yard, where seven other motorships are also under construction for the same firm. Altogether it is stated that the East Asiatic Company has contracted for some 15 or 16 motorships, six of which will have a deadweight carrying capacity of 13,000 tons while several will be considerably bigger.

The *Malaya* and the *Java* are practically similar to the *William Penn* recently built for the United States Shipping

Board and are equipped with a couple of the standard 2,250 indicated horsepower Burmeister and Wain four cycle motors. The fuel consumption of the sister ship *Afrika* works out at approximately 14 tons per day, which is certainly a very moderate figure for a ship carrying 13,000 tons of cargo at a speed of 12 knots.

NEW GERMAN MOTORSHIPS

Germany having handed over most of her steamers to the Allied Powers under the terms of peace is now apparently commencing to build up a new mercantile fleet a large part of which will be propelled by oil engines. Very little information is available as to what is happening but it is known that many of the craft being built by Blohm and Voss and at the Howaldtswerke at Kiel are to be engined with internal combustion machinery, and at the latter yard two hulls are approaching completion, in each of which a couple of 1,250 brake horsepower Sulzer two cycle engines will be fitted. These engines, one of which is shown in Fig. 2, are being built in Germany at the Ludwigshaven Works of Sulzer Brothers.

Blohm and Voss and Krupps are both building their own machinery for installation in motorships and it is understood that the former is manufacturing double acting Diesel engines somewhat similar in design to those which were fitted in the motorship *Fritz* recently handed over to the British Government.

There has always been a strong belief in Germany in the possibilities of the double acting two stroke motor and it will not be surprising if some noteworthy developments transpire within the course of the next few months. The two motorships now being built at Howaldtswerke are cargo boats for the Hamburg-South America Line and will each have a deadweight carrying capacity of about 9,000 tons. They are to trade between Hamburg and South American ports.

There is a tendency among European engine builders to increase the size of semi-Diesel engines and to bring them into competition with Diesel motors for vessels up to 3,000 tons deadweight capacity. One firm is experimenting with a 1,000 horsepower four cylinder hot bulb set, Beardmores are building the same type up to 600 brake horsepower and Vickers Petters are now constructing 500 brake horsepower motors of six cylinders, one of which is shown in Fig. 1.

This is one of the first six cylinder European semi-Diesel engines that has yet been constructed although some of the type were built in America. It is of course directly reversible by means of compressed air, the whole of the reversing operation being carried out by means of the handwheel seen in the center of the engine. The rotation of this wheel causes starting air valves to be opened, admitting starting air to the right cylinders for turning in the ahead or astern direction as may be required.

The engine runs at 250 revolutions per minute and has cylinders $16\frac{1}{2}$ inches diameter by 19 inches stroke and is fitted with the Vickers quick starting system by which it is possible to start from cold in about three minutes. In this respect therefore it suffers little disadvantage as compared with the Diesel type. Its chief novelty apart from the employment of six cylinders lies in the bilge and circulating water pumps seen on the right, which are run at very slow speed, having been geared down to about 90 revolutions per minute.

Gravity Type Lifeboat Davits Installed on Passenger Vessels

AMONG recent developments in lifesaving equipment is the gravity type lifeboat davit which is being installed on the eight new ships of the Holland-America Line. This device is being demonstrated in the United States by the In-



Fig. 1.—Boat Being Swung Out Against a List of 15 Degrees

ternational Nautical Trading Company, the head office of which is at No. 3 Kanaalstraat, the Hague, Holland.

Under the Schat system, so called after its inventor, the lifeboat rests in two chocks each of which consists of two parts fixed to the deck which form points of support for a rotary moving section mounted between them. The pivot for this rotating part is out of line with the keel of the boat so that collapsible members of the chocks are inclined at all times ready to collapse. A cam hook for one or both chocks pre-

vents their collapse until they are to be put in operation when a slight force applied to the locking mechanism releases the apparatus. The in and outboard grips are fixed on slip hooks which open towards the water side of the vessel.

The davits are mounted in frames which permit them to rotate and the lifeboat lies between them in the chocks in

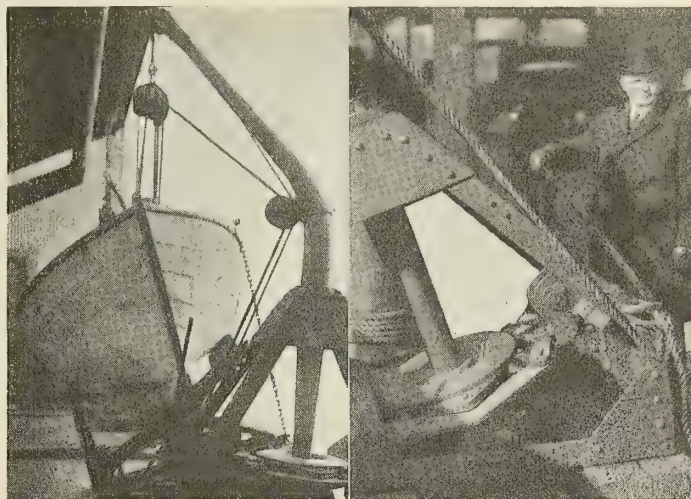


Fig. 2.—Boat Lying in Chocks Fig. 3.—Showing Hand-Operated Braking Mechanism Listed 15 Degrees

such a way that the lower part of the davits is at any desired angle usually about 20 degrees from the perpendicular to the deck. Because of this angularity with the vertical line, the davits have a tendency to swing outboard as soon as the lifeboat is released from the chocks and a special brake is fitted on the straight part of the davit near the lower bearing to control this rotating speed in such a way that the davits may be stopped at any required position.

The upper block is not connected to the davit head but is suspended to a wire rope which is in turn connected by means of a bell crank and brake levers to brake shoes so arranged that they can at will be forced into grooves of the disk brake which controls the rotation of the davit.

When it is desired to put the apparatus in operation the movable parts of the chocks are freed and collapse under the lifeboats' weight so that the boat hangs free from the toggles. The brake shoes of the davits then come into operation and, when released the davits swing outboard by gravity. Since the davit heads move in a downward direction the grips are allowed a slight amount of slack so that they are released from the slip hooks without the necessity of loosening the slip hooks, stretching screws, etc.

SHIPBUILDING IN AUSTRALIA.—The Melbourne correspondent of the *Times Trade Supplement*, London, states the former Controller of Shipbuilding, Mr. H. W. Curchin, has informed the Government of Australia that the cost of construction in Australia is considerably lower than in Great Britain. He states that the type of vessel now being built in Australia by the Government would cost about £32 (approximately \$128 at the present rate of exchange) a ton, whereas the cost in Australia was only £28 (\$112) a ton. The Minister for Home and Territories, Mr. Poynton, who controls shipbuilding operations in Australia, said that the cost of the latest vessel launched from the Williamstown yards was £25 (\$100) a ton, and when ready for sea the cost would be about £28 (\$112) a ton. Commenting on statements that some of the piece workers at the Williamstown shipyards were earning very high wages, the Minister stated that the average wages earned by boiler makers on piece work were from 28 shillings (\$5.60) to 30 shillings (\$6) a day.

Standardized Diesel Engines—II*

Discussion of Construction Involving Four Valves in Cylinder Head—A Maneuvering Compressor

BY H. R. SETZ

OF fundamental importance in the design of a valve gear for four cycle engines of larger bore is the use of dual valves. The beneficial effect of using pairs of small valves instead of a large single valve is of vital importance for the entire valve motion, for the valves themselves and for the cylinder head casting.

FOUR CYCLE VALVE GEAR

The exhaust valves of a four cycle engine must open against a very considerable pressure still remaining in the cylinder near the end of the expansion stroke. Since this pressure amounts to something like 50 pounds per square inch, the force which it exerts on a valve of sufficient area to clear the cylinder is a large one. Because of the weight of the levers, push rods and rollers, which must be large enough to overcome the gas pressure without undue deflection, severe kinematic loads due to accelerating these parts are additionally imposed. The reaction on the cams deflects the camshaft, disturbs the delicate timing of the fuel valves and causes noticeably accentuated wear on those camshaft gear teeth meshing at the instants when the exhaust valves begin to be lifted. With the use of two valves in the place of one large one, all the affected parts become lighter and the lifts smaller; the resulting improved kinematic conditions manifest themselves in reduced cam reactions.

As regards the exhaust valves themselves, a reduction in their size is a substantial safeguard against warping with its attendant leakage and smoky combustion. Here again small size is of value, as is shown by the fact that exhaust valves of small engines do not present nearly as great problems as do those of large ones. Pitting and other deterioration of the valve seats become less and permit the use of lower grades of fuel oil.

ADVANTAGES OF FOUR VALVE CONSTRUCTION

The use of four valves of small diameter permits their grouping within the contour of the cylinder bore, thereby reducing the diameter of the joint between cylinder head and liner. As a consequence, the load due to gas pressures is reduced. Smaller studs can be used and the bending moment in the casting is decreased because of the smaller bolt circle. Two exhaust passages are lower in height than a single one of the same area; therefore the height of the cylinder head casting is reduced and requires shorter and hence less elastic studs to hold it down. The grouping of the valve pockets makes possible a better defined circulation of cooling water, especially if used in connection with the baffle plate mentioned before and the central cooling water circulation shown in Figs. 2 and 3. A concluding consideration of equal significance from the point of view of eliminating cracked cylinder heads is the fact that the four valve arrangement requires small holes in the cylinder heads and results in a structure better suited for resisting the mechanical and heat loads to which it is exposed.

Some designers who have appreciated the merits of the four valve construction have made the irretrievable error of placing the two exhaust valves in the same discharge passage so that the blast of the rear valve impinges upon the one in front of it. Everyone knows that an exhaust valve suffers enough from its own fire. To subject it to an additional and simul-

taneous blast of practically the same intensity means that the advantages of the four valve construction are thrown away and wasted. Such a practice aggravates the very evils which it is intended to cure and would not be justified even if the claim of a simple valve gear which is made for this arrangement were true.

A key to the understanding of the four valve design herewith presented is the realization that the exhaust valves have here been placed in such a way that they can be neatly provided with separate and independent exhaust passages (see Figs. 7 and 8). Each exhaust valve is operated by a double

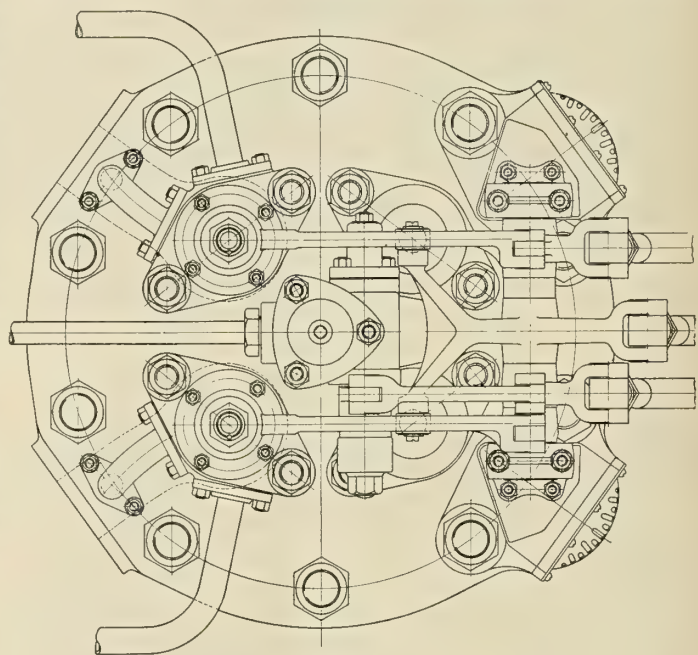


Fig. 7

cam on the end of a horizontally swinging cam rod, both of the latter receiving their reciprocating motion from one push rod through suitable levers keyed to the fulcrum shaft. The lower one of the two cam rollers is mounted on the exhaust valve spring guide, whereas the upper one has a fixed position in the valve cage which permits of slight adjustments in accordance with the clearance that is desired. This adjustment can be made while the engine is in operation.

This valve gear readily permits of access to an exhaust valve cage for removal by merely taking out the pin in the lever which operates the cam rod and withdrawing the latter. The cam rods can also be used at will to cause a slight advance in the timing of one valve with respect to the other. The severe working conditions to which an exhaust valve is subjected are thereby alleviated and further improved because of the fact that kinematic forces, instead of manifesting themselves as a single impact, are divided between two noticeably smaller force applications.

Owing to the easier working conditions of the inlet valves, a single push rod is used to actuate them through a forked rocker lever. The details of the operation and lift control of the inside spring fuel valve will be considered later. Reversal is effected in a well-known manner by swinging the ends of all the push rods from the ahead cams to the astern cams.

* Copyright, 1921, by H. R. Setz.

Since starting and maneuvering are accomplished by means independent of the working cylinders (see next section), the double roller push rod ends for exhaust and inlet need never be swung into a neutral position. Only the low fuel cam noses need be cleared, so that the shift angle through which the exhaust and inlet rollers must be traversed is merely that necessary to insure clearance between the idle roller and its cam while the other roller is operative. Conversely, also, compression relief is secured without adding a single extra part by the simple expedient of setting the double rollers in the mid-position.

While it is realized that the four valve operating linkage is somewhat more complex than the conventional two valve arrangement, the resulting advantages combined with the simplification due to the maneuvering compressor more than justify it. Considering the greater directness and fewer parts with which compression relief and reversibility are thus obtained, the arrangement must be credited with a substantial overall gain in simplicity.

MANEUVERING COMPRESSOR

The starting, and for marine service also the reversing, of large Diesel engines is a problem whose solution can be neatly accomplished by using the cylinder displacement of the low stages of the injection air compressor. The requirements so far as the design of the compressor itself are concerned can be readily met and the advantages as regards simplification and improvement of the main engine are far-reaching and substantial. Complex valve gear, reversible in the case of marine engines, and the manufacture of a large number of expensive parts, whose low usage factor makes them a drag on the overhead and upkeep of the machine, are eliminated. Accessibility to the remaining gear is improved and the design of the cylinder head casting, especially in two

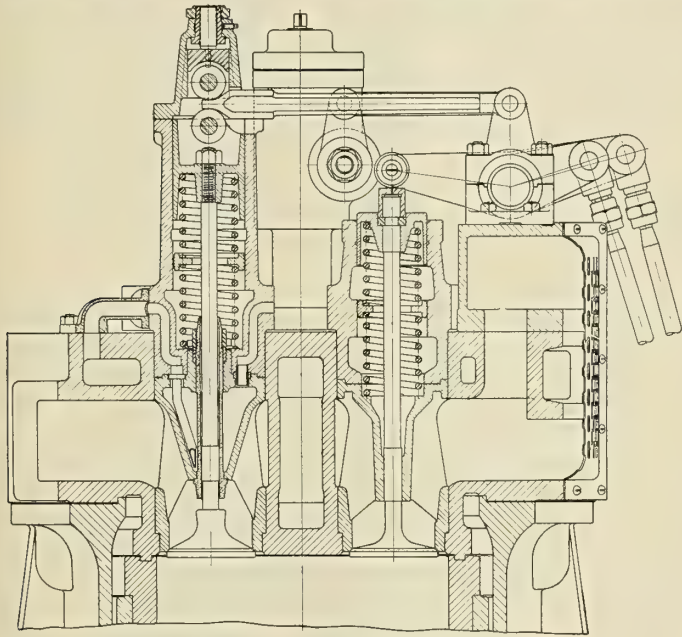


Fig. 8

cycle and double acting engines, can be better adapted to meet the severe demands to which this part is subject. An advantage of signal importance for marine engines is the elimination of alternate refrigeration and heating which occur in the cylinders of the usual types of Diesel engines while maneuvering.

Since an injection air compressor must have a displacement sufficient to charge starting air reservoirs during those intervals in which the main engine runs on fuel, its capacity is also sufficient to re-utilize the air when running as an air motor. Surely, if it is practical to re-utilize air by blowing

it into the clearances of the working cylinders, its use in compressor cylinders, whose clearances are reduced to the utmost minimum, will be enough more economical to preclude any excessive requirements for compressor capacity. If it were a question solely of bringing an idle engine up to the starting speed, there would have been no need for broaching the question of power delivery from a temporarily converted injection air compressor. The severest demands upon such an arrangement that can be reasonably made are those of reversing an engine against the full headway of a ship. Owing to the lack of experimental data regarding power requirements for starting and reversing marine Diesel engines, the problem can be handled only in a general way; but the empirical knowledge which is available justifies some interesting estimates.

A STUDY OF PROPELLING CHARACTERISTICS

Fig. 9 shows the propeller characteristics of the United States battleship *New Mexico*. The measurements on which

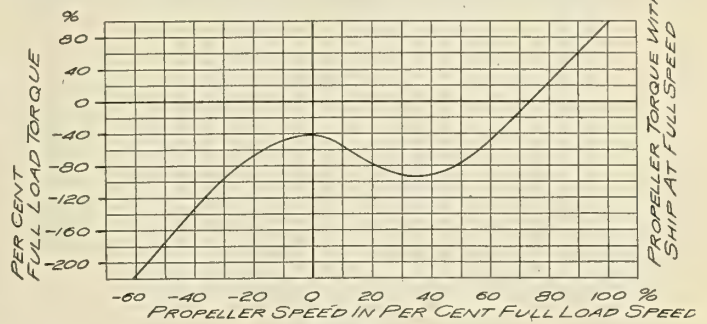


Fig. 9

it is based are electrical and were made on the driving motors of the ship. Beginning our examination at the upper right hand corner of the plot, we note that the curve passes through the point indicating 100 percent propeller speed and that naturally 100 percent mechanical torque must be supplied to it.

If the speed of the ship remains constant (this is a useful assumption of sufficient accuracy if the time interval is not too long, as in the case of reversing in a headway) and if the propeller speed is to diminish, less torque is required to keep it running at the reduced speed. To keep the propeller turning, say, at 90 percent of full speed would require the application of 60 percent full torque, the ship's speed remaining constant for the time being. When the torque falls to zero, as is very nearly the case when the propelling motor is deprived of all excitation, the propeller continues to revolve at 73 percent full speed.

Descending the curve below the line of zero torque, we find that a negative torque or braking moment must be applied to the propeller in order to make it revolve at a speed lower than the one at which it will idle along. Like any water wheel (as such a passive propeller may be regarded) it has a definite speed at which the water flowing past it will exert upon it the maximum turning effort. In the case of the blading here considered the speed of maximum torque is reached at 35 percent of the full driving speed. Naturally the maximum active torque of the propeller has nothing to do with the negative maximum here considered because it stands to reason that the maximum motor torque required by a propeller must be supplied at a speed exceeding its pitch speed and that, like a water wheel, it will be subjected to a maximum water torque at a speed below that corresponding to its pitch. Hence, as we follow the curve still further to the left we find that less braking torque need be applied at the lower propeller speeds in spite of the increasing water velocity relative to the blades moving at a speed which deviates increasingly from the speed of maximum water torque.

Here is a fact of high importance from the standpoint of

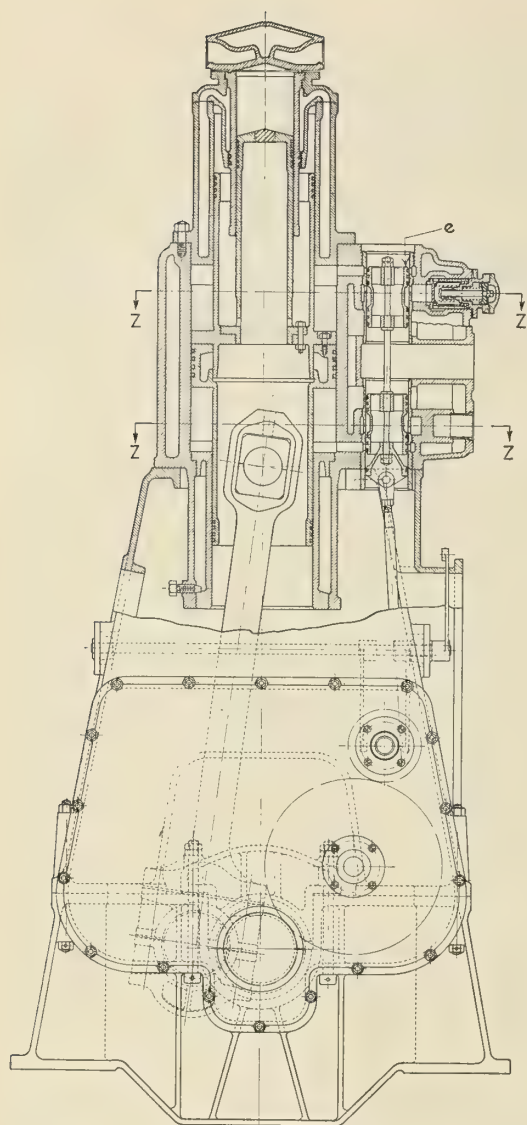


Fig. 10

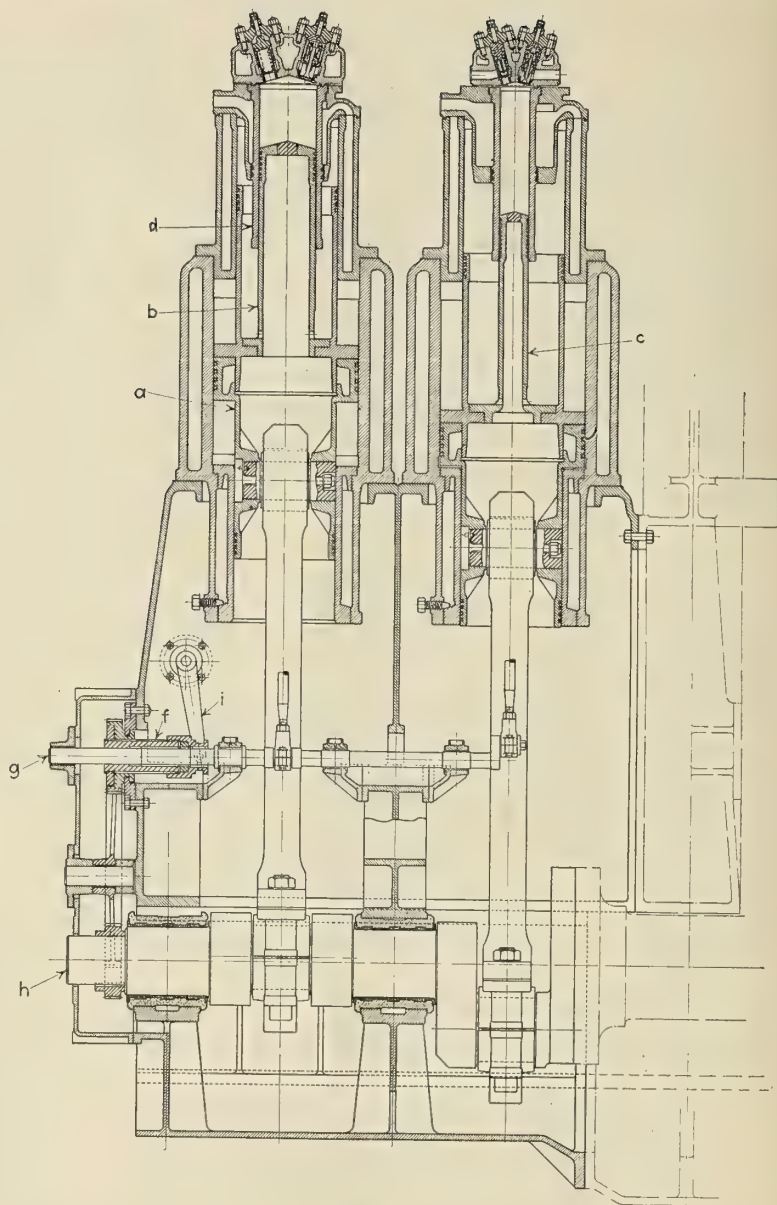


Fig. 11

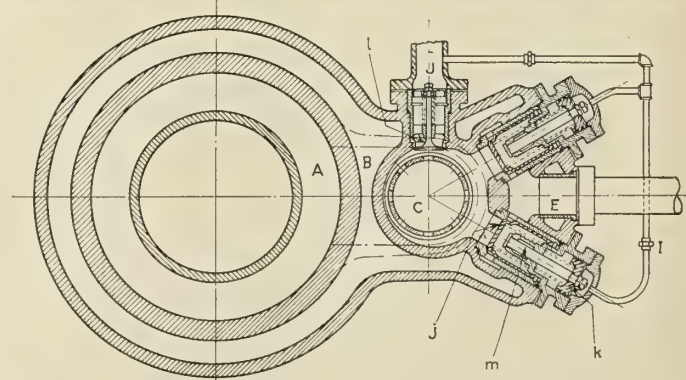
maneuvering compressor design. Once it has been possible to supply a braking torque of about 94 percent (under the conditions represented by the curve) the propeller must come to rest because the more slowly it moves after being retarded thus far the less torque is required to retard it further. The curve crosses the line of zero propeller speed at minus 42 percent, showing that it takes less than half the full power torque to start the engine astern. If 100 percent torque capacity is provided, there will remain an ample margin for accelerating the engine in an astern direction up to the speed where ignitions in the working cylinders can occur. Under actual conditions of an immediate reversal the ship will have lost momentum, the rush of water past the propeller will be less and its torque resisting reversal will be less than that indicated by the figures.

DESCRIPTION OF COMPRESSOR

A compressor in the design of which these considerations have been taken into account is shown in Figs. 10, 11 and 12. It is dimensioned for an 800 brake horsepower engine running at 140 revolutions per minute and having a gross working cylinder displacement of 36.7 cubic feet per revolution. This engine exerts a full load shaft torque of 30,000 foot pounds.

The twin cylinder compressor is chosen primarily to insure safe starting in all crank positions when running as an air

motor. The throws are naturally spaced 90 degrees apart. The double acting, low pressure pistons *a* can also be proportioned in a manner which, in combination with the smaller pistons *b* and *c*, yields the proper volume ratios for four-

Section Z-Z
Fig. 12

stage compression. The upper large cylinder ends of both compressors and the lower end of the right hand one all deliver air into the same intercooler. The remaining one of the four large cylinder ends draws air out of this intercooler and,

after subjecting it to first intermediate compression, delivers it to the intercooler leading to the second intermediate cylinder *d*. The piston extensions or trunks are provided in order to accommodate the upper connecting rod bearings. The net area of the low pressure pistons, after deducting that part which is taken up by the piston trunks, amounts to 131.8 square inches each and the common stroke is 16 inches.

As has been stated, three of the low pressure cylinder ends draw in fresh air for compression into the remaining one.

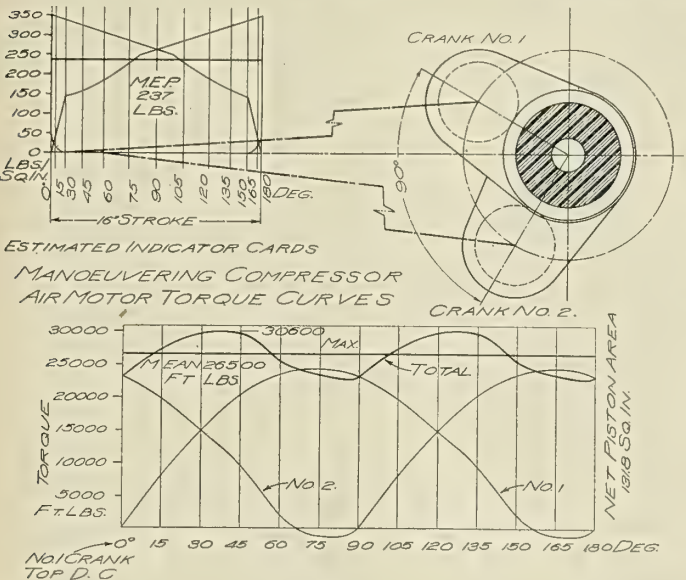


Fig. 13

The cubical displacement of these three ends is 3.67 cubic feet, or .20 of the 18.35 cubic feet of the effective working cylinder displacement. For large modern engines fitted with fuel valve lift and timing control to suit load and speed variations, the accepted proportioning of compressor capacities may be expressed as follows:

$$C = RW$$

- C = cubical displacement of compressor.
- W = cubical displacement of working cylinders.
- R = a constant.

$$W$$

For four cycle engines $\frac{W}{2}$ must be used instead of *W*.

A range of values for *R* frequently found on heavy duty four cycle engines is from .18 to .2.

When running as an air motor provision is made for supplying all four cylinder ends with starting air at 350 pounds per square inch, at which pressure they develop the torque shown in Fig. 13. The percentages of cut-off shown on the estimated indicator diagrams are a minimum for the valve gear used and a pressure drop due to throttling during admission equivalent to 100 pounds per square inch is assumed. Since frictional resistance within the mechanism is a highly indeterminate quantity, no allowance has been made for it. An ample margin is afforded by the possibility of varying the starting air pressure to counteract any errors due to estimating friction or to other causes. The minimum indicated torque shown in the diagram amounts to 23,500 foot pounds, or 70 percent of the main engine torque. Forty-two percent, we have seen, is the maximum that could possibly be required to start the engine backwards while the ship is under full headway. The curve shows a maximum of 30,600 foot pounds, a torque slightly exceeding that of the main engine under full power. Only 94 percent is required to bring the engine to a standstill under the most unfavorable assumptions.

The advantages of eliminating the high starting air pres-

ures usually employed need hardly be emphasized. Ordinary riveted starting air reservoirs can be used and no special tubing, fittings and joints are necessary for connecting them to the engine.

VALVES AND VALVE GEAR OF COMPRESSOR

The valves and gear by means of which the maneuvering compressor is controlled are simple and require no cumbersome expedients for effecting reversal or for converting the machine from a compressor to a motor or vice-versa. Referring to Figs. 10 and 11, it will be seen that the essential elements of the valve motion comprise piston valves *e* and a geared drive whose angular phase relative to the main shaft can be shifted by means of helix *f*. In the arrangement shown, the well-known fact that a compressor with mechanically driven valves will run reversed as an air motor when supplied with compressed air is taken advantage of. All that is necessary to make the machine run in the same direction which it had when compressing air is to reverse the angular phase of its valve drive. To make it run in the opposite direction it is required merely to connect the air reservoirs without shifting the control. The ahead or astern lead of valve

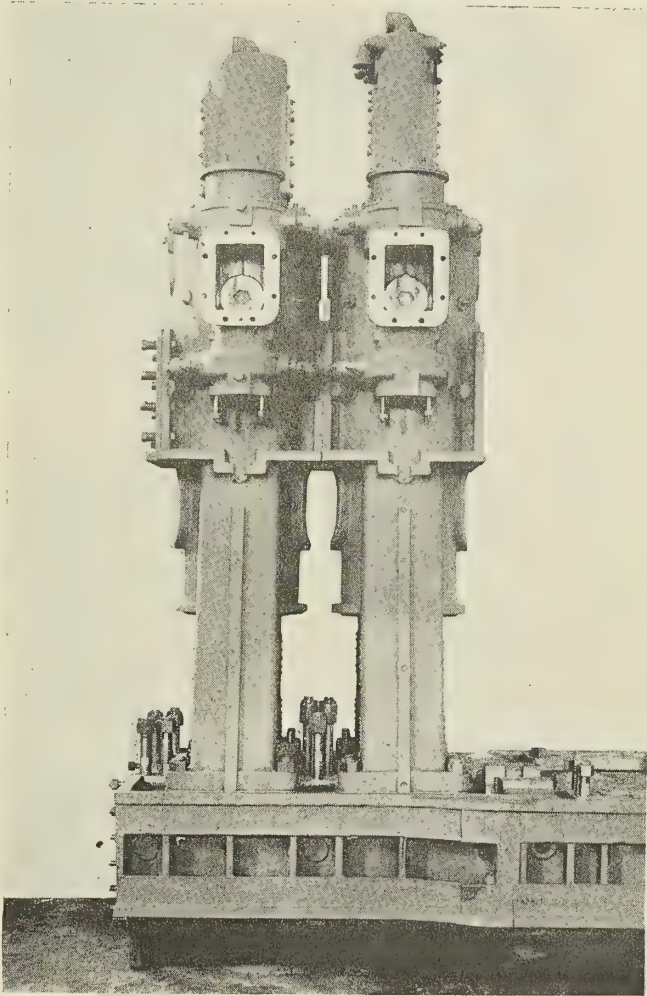


Fig. 14.—Compressor and Starting Engine, 550 Horsepower M. D. E.

cranks *g* relative to main cranks *h* is determined by means of helix *f* and lever *i*.

To eliminate the effect of too long a delivery (cut-off) inherent in piston or slide valve control of compressors, auxiliary discharge valves *j* (Fig. 12) are provided. These prevent the cylinder from discharging until its contents have attained the proper pressure. For motor operation, the auxiliary discharge valve *j* is held upon its seat by means of balance piston *k*, actuated automatically by starting air entering through

pipes *I* communicating with starting line *J*. The check valve *l* reduces cylinder clearance. Air is exhausted through the same mufflers which served as silencers for the suction of the compressor. In the case of the first intermediate stage cylinder end a positive transfer valve switches its suction (which has now become an exhaust) from the first intermediate inter-cooler to the atmosphere. The starting air pipe *J* is vented as soon as starting air is turned off, a provision which insures positive seating of valve *l* and the return of stops *m* during compressor operation.

Since the process of converting the compressor into an air motor and turning on starting air can be accomplished by hand operating a single lever, the simplicity of this maneuvering system compares most favorably with those found on other installations. With the exception of the high and second intermediate pressure ends respectively, both main cylinders with their pistons, valves and connecting rods are alike and interchangeable in every detail and of a size which makes them a relatively small part of the engine proper.

Fig. 14 shows a maneuvering compressor as built by a prominent firm engaged in Diesel engine manufacture. It is installed and operated on a number of ships fitted with engines of their make.

THE TWO CYCLE ENGINE

The two cycle engine has had a much more desultory development than the four cycle, and at the time when the main impulses to bring out this type of engine occurred less than ten years ago large units were undertaken without anything like the gradual preparation which preceded four cycle constructions. Many particular problems inherent in and peculiar to the two cycle machine were not properly considered or even understood and the practical accomplishments of over-enthusiastic and ill-conceived attempts could be none else than disappointing. The severity of the conditions under which early two cycle experiences were gained was aggravated because installations of large units were made on ships and presented operating difficulties far more trying than the heaviest central station requirements.

The years that have elapsed since then have given an opportunity to devote the same systematic study to the essential requirements of satisfactory two cycle Diesel engine con-

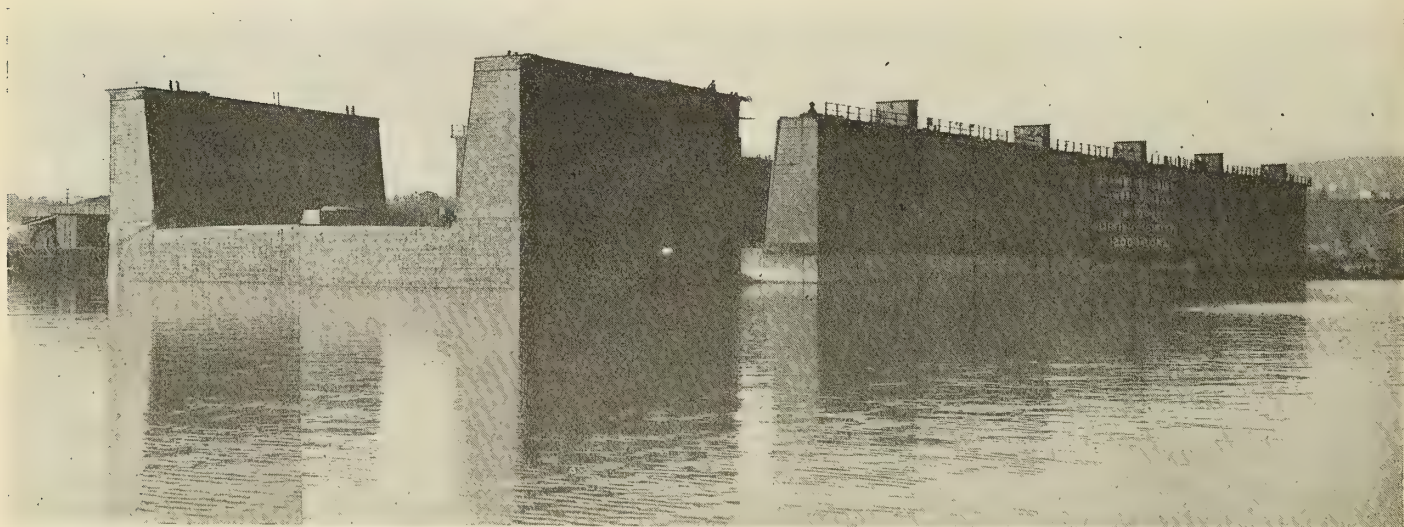
struction. Experimental information has been secured, with the result that the more recent development for applications of the two cycle type bids fair to exceed in short time the progress which has been made in the four cycle engine field. At the present time two cycle installations aggregate approximately 750,000 horsepower. The fact that this output is realized in comparatively few units shows unmistakably that the field for large Diesel engine units is pre-eminently one for two cycle application.

The reasons for this are not far to seek. Approximately twice the output of the four cycle engine is attained for the same piston speed, or, conversely, for the same horsepower output the bore of the cylinders may be materially reduced, a procedure which more than offsets the greater frequency of the heat impulses sustained in the two cycle engine. The objections on the score of heating have lost much of their force because it is possible to design cylinder heads, the most vulnerable parts of a Diesel engine, with a scientific and positive water circulation that minimizes such troubles. Finally, the difficulties ascribed to non-reversing bearing pressures occurring in the single acting, two cycle engines have been deprived of their seriousness because of other materially improved bearing conditions. A crank shaft with short and thick pins and journals, ample areas and a frame construction which protects bearings against deflections, are features which outweigh a none too well established theory of pressure reversals.

Scavenging air can be supplied from a source independent of the engine, preferably from an electrically driven turbo compressor. The high degree of perfection and reliability which have been attained in these simple machines recommends them emphatically for substitution in place of the lumbering piston pumps. On shipboard they afford a notable economy because they can be operated with current from auxiliary engines which would otherwise be used only while in port and would therefore be a drag on the installation because of their low usage factor. An even greater advantage of auxiliary driven scavenging air supply on ships is that its pressure is maintained during maneuvering and slow running of the main engines. Hence in all the two cycle work here considered direct driven scavenging pumps and their attendant features will be conspicuously absent.

(To be continued.)

LARGEST FLOATING DRY DOCK IN SOUTH PACIFIC WATERS



By Far the Largest Floating Dry Dock in South Pacific Waters is That of the Los Angeles Shipbuilding & Dry Dock Company, Los Angeles, Cal. It Measures 540 Feet With 84 Feet Beam and Will Raise Vessels Up to 12,000 Tons

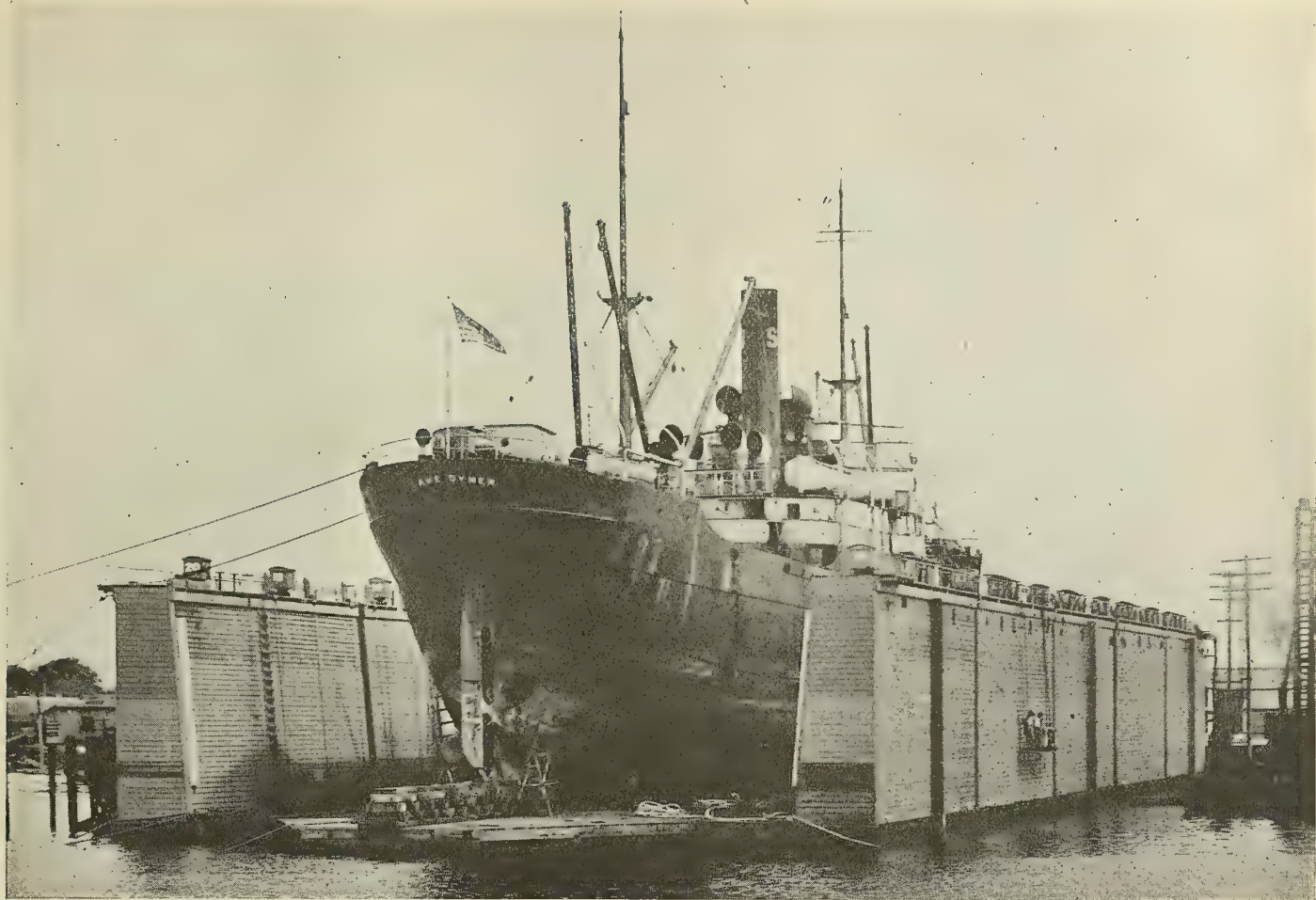


Fig. 1.—*Lake Dymer*, First Ship on New Floating Dock

New Floating Dry Dock at Pensacola

Longitudinally Trussed Timber Dock of 6,000-Tons Lifting Capacity—Details of Construction and Pumping Arrangement

APPRECIATING the growing importance of the Gulf ports in the world shipping trade and realizing the necessity for increased dry docking facilities at Pensacola the Bruce Dry Dock Company was formed during the fall of 1917. The company acquired the sixty-year old 1,000-ton floating dock built before the Civil War by Bruce and Ollinger, put it in operation and then immediately began to make investigations with a view to getting a larger floating dock, and increasing their repair plant.

After studying the various types of floating docks the company engaged The Crandall Engineering Company, East Boston, Mass., to design a 6,000-ton capacity timber dock of the longitudinally-trussed type. Construction was actually begun in August, 1919, by Aberthaw Construction Company and the first pontoon was launched the middle of December of the same year and a pontoon launched monthly until April when the last pontoon slid into the water. By the middle of June the fitting up was completed, the five sections were joined together and the electric wiring installed ready for operation.

The first vessel dry docked was the *Lake Dymer* which was raised in about 30 minutes from the time the pumping commenced, everything running smoothly. The pumping was controlled from the headhouse on the wharf and the success and ease of this method of centralized control demonstrated the wisdom of the design.

The general dimensions of this dry dock are 380 feet over the keel blocks, 74 feet between the wings and 18 feet of water over the blocks. It is made up of five pontoons each 62 feet long.

LONGITUDINAL TRUSSES

In each wing wall of the pontoons is incorporated the panel of a longitudinal truss. These trusses are built up of timber compression members and steel tension members which terminate in steel castings at the panel points, which castings are furnished with lugs for joining the sections together, as illustrated in Fig. 2. When the sections are joined these truss panels are formed into one longitudinal truss along each wing of the dock. These trusses make the dock operate as a unit instead of as a number of loose sections and thereby equalize any unequal buoyancy of the sections due to irregularity of pumping, safeguarding any vessel dry docked from severe stress and distortion due to this cause.

TRANSVERSE TRUSSES

The type of transverse truss frequently used in wooden floating docks has certain inherent faults of design and construction and is subject to extreme deflection. For the transverse truss, therefore, a type was developed which would approach as nearly as possible a perfect truss for this work, namely one that would have minimum deflection, minimum cost and maximum strength. Fig. 2 shows the type developed,

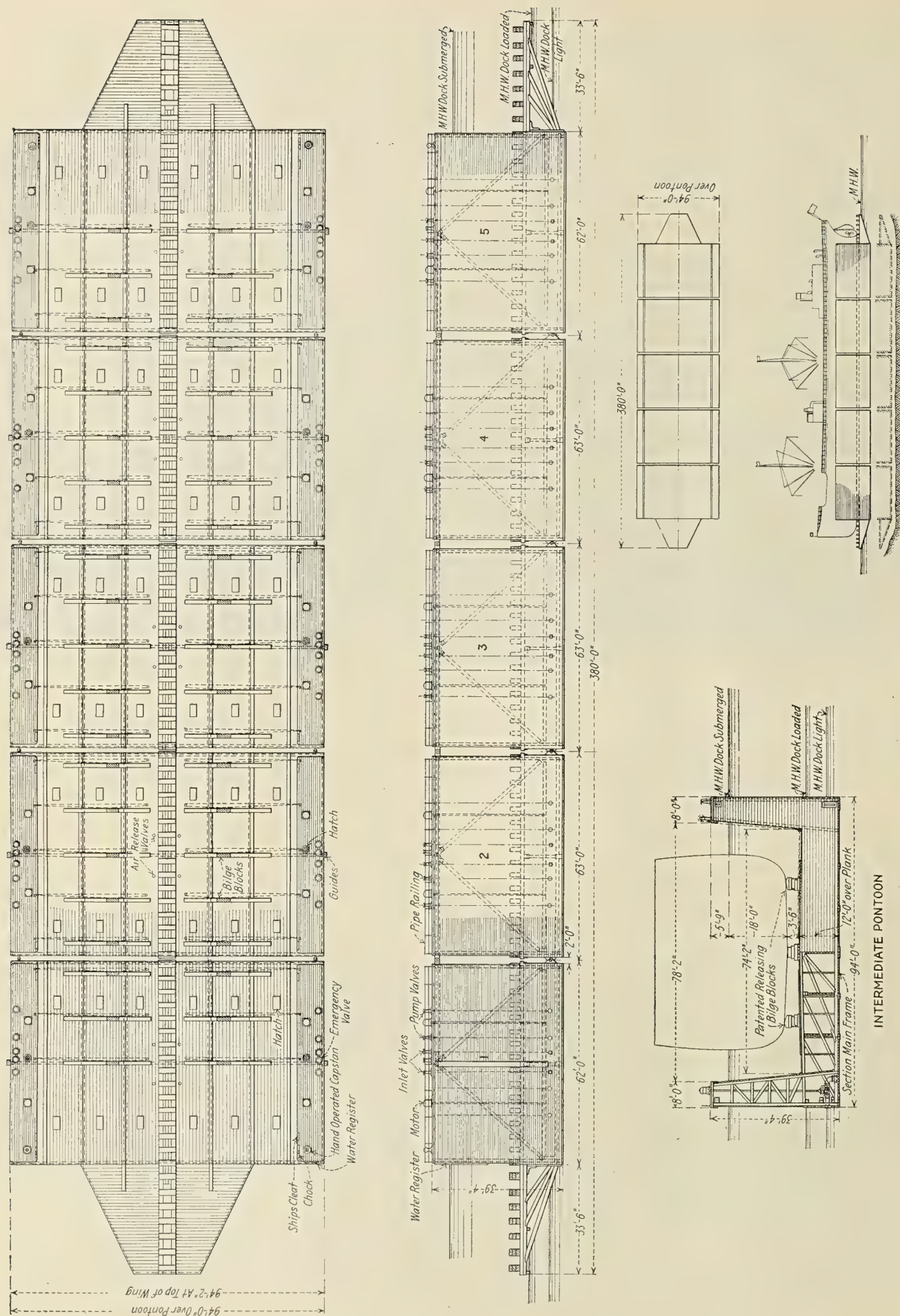


Fig. 2.—Plan, Elevation and Sections of New Pensacola 6,000-Ton Floating Dry Dock

the problem being a statically determinate one in which the stresses can be accurately determined and the sizes of timber properly proportioned with proper factors of safety for the stresses involved and the economy and rigidity of this type have been amply proved by this and other docks of similar design.

PUMPING ARRANGEMENT

The pumping is done by means of twenty 10-inch centrifugal pumps, four in each pontoon, each of which is direct con-

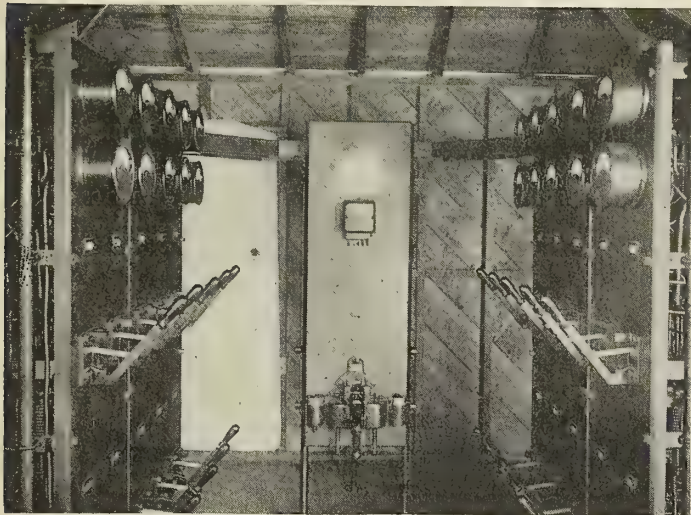


Fig. 3.—Control Board Showing How Control is Centralized

nected to 20 horsepower motors. The control of these motors is centralized in a control house on the wharf structure where the dockmaster can see the indicators showing the height of water in each compartment and govern the pumping accordingly. A full capacity vessel can be lifted clear of the water ready for repairs in less than forty minutes.

ABSENCE OF BALLAST

Although an all timber dock, no rock ballast is used to sink it to full draft. Instead a very simple water ballast sys-

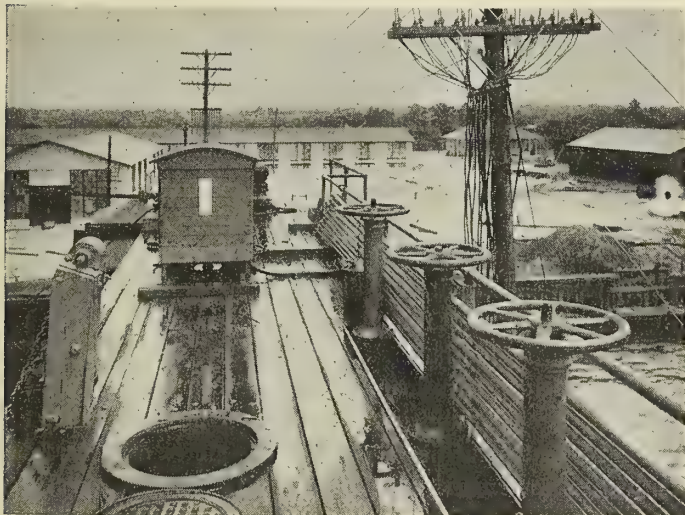


Fig. 4.—Wing Deck View, Looking Inboard. Motorbox, Valve Operating Stands and Bilge Block Operating Winch

tem is used. By this means the full lifting capacity of the dock is available to raise a vessel instead of from 20 to 25 percent being required to raise rock or other ballast, and thus unavailable and wasted.

Entering into the cost of this dry dock are 1,300,000 feet of yellow pine lumber and 15 tons of steel castings. The motors were furnished by the Wagner Electric Company, St.

Louis, Mo.; the pumps by the F. H. Hayes Machinery Company, Boston, Mass., and the switchboard apparatus by the Condit Electrical Manufacturing Company, Boston, Mass.

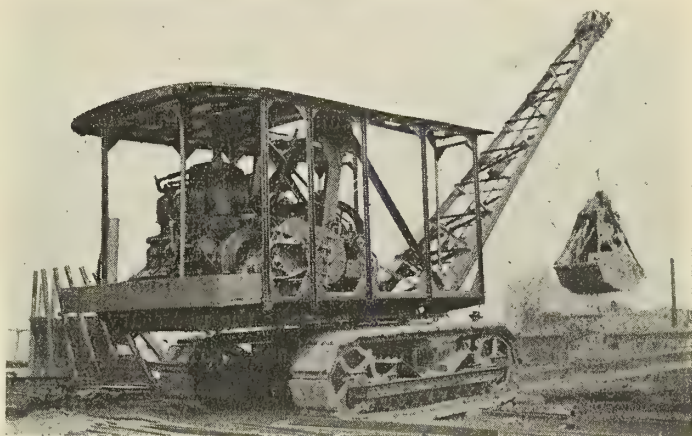
The dock was constructed by the Aberthaw Construction Company, Boston, Mass., and supervised by Paul H. MacNeil, field engineer for the designers, the Crandall Engineering Company, East Boston, Mass.

Northwest Crawler Crane

ONE of the latest products of the Northwest Engineering Works, Chicago, Ill., is the Northwest crawler crane. Traveling under its own power on two manganese crawler type wheels, the crane is built to go anywhere, any time, like the war tanks, and is steered as easily as a truck with the boom in any position. It is equipped with self-aligning ball bearings or bronze bushings with no babbitt boxes, and 41 percent of the weight of the complete crane consists of manganese or carbon steel castings.

The machines are built on full revolving, rotating bases equipped with extra heavy 4-cylinder, 60-horsepower gasoline engines and will operate a one cubic yard clam shell or three-quarter cubic yard drag line bucket, pile driver hammer, wood grapple or electric lift magnet.

The lifting capacities range from 20,000 pounds at a 12-foot radius to 5,200 pounds at a 30-foot radius. A single lever in the operator's cab manipulates the steering device so arranged that both crawlers are driven at the same speed



Crawler Crane Operating a Grab Bucket

straight ahead or with different speeds for steering positively in any direction required. The machine will mount a coal or stone pile as easily as it travels along a good highway and is especially adapted for unloading cars or barges.

R. C. Rimmer of 149 Broadway, New York City, naval architect and consulting engineer, has been appointed assistant sales manager for these cranes.

The Superheater Company

Soon after taking over the patents and business of the Locomotive Feed Water Heater Company, the Locomotive Superheater Company, New York, changed its name to The Superheater Company.

Together with its production of superheaters for all manner of steam power generators, the organization has also become actively engaged in the intensive development of feed water heating equipment for locomotive and marine application. The Superheater Company wishes to renew its assurance of service to all companies with whom it has been able to co-operate in the past and also to offer the facilities of its organization to any company having problems in fuel conservation to solve.

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WE GUARANTEE, that of this issue 6,800 copies were printed; that of these 6,800 copies 5,448 were mailed to regular paid subscribers, 360 were provided for counter and news company sales, 266 were mailed to advertisers, 85 were mailed to employees and correspondents and 641 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 32,600, an average of 8,150 copies a month.

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Immediate Action Demanded

THE failure of the new administration to nominate a new Shipping Board in time for confirmation by the Senate before its adjournment was most unfortunate and it is to be hoped that this matter will receive the earliest consideration that the President can give it so that the Senate may act immediately upon assembling at the special session this month. It is evident that the President feels that the position of chairman of the Shipping Board requires the services of one of the biggest men that the country affords and, while we appreciate the difficulty in securing the services of such a man who is willing to make the necessary personal sacrifices, the welfare of our merchant marine demands immediate action if we are to derive any benefit from the most gigantic shipbuilding effort ever attempted by any country.

Admiral Benson

ALTHOUGH the status of Admiral Benson's position on the Shipping Board is, at the time of this writing, somewhat uncertain, it cannot be said that the Admiral has not made his position plain on those policies which he thinks will be for the best interests of our merchant marine and there are very few if any of those who criticize these policies who doubt that in his straightforward pleas for the maintenance of the merchant marine he is guided by the most sincere and patriotic convictions. It ought to be evident to everyone as well as to the Admiral that the time for debate, investigating committees and destructive acrimonious criticism is past and that now is the time for us to take off our coats, lay out a straight line of action and work to it.

The Admiral is anxious to be put on record as heartily in favor of the Merchant Marine Act of 1920 and he is opposed to any movement that purposes to take the teeth out of this law until it has had a fair trial. The preferential rail export rates which this law provides for American ves-

sels and the provisions for discriminatory custom duties and tonnage dues should be put into full force, says the Admiral, and in this connection it should be noted that these preferentials are designed to help shipbuilding as well as shipping. Shipbuilding, on which the American wage standards protected by a tariff on manufactured and agricultural products exert a vital influence, cannot flourish while other industries are not only protected but charge the shipbuilders appreciably higher prices for most of the equipment that goes into a ship and shipyard on account of this protection.

Whether Admiral Benson's views are adopted as the future policy of the new Shipping Board or not he has performed a distinct service in outlining a definite and comprehensive line of action. He has considered the welfare of shipbuilding as well as shipping, the vital necessity for an American built and manned merchant marine as a naval auxiliary and he believes that the best way to accomplish this is to put into full force all the provisions of the Merchant Marine Act.

Our Foreign Trade

THE solution of our foreign trade problems has become vitally imperative and it not only affects the future success of our merchant marine but the prosperity of the whole country and particularly the great agricultural and manufacturing interests of the Middle West. We have an enormous surplus supply of grain consisting of several hundred millions of bushels above the country's normal needs. We have vast supplies of raw materials, for example, millions of bales of cotton, standard articles of manufacture and manufactured specialties which must be sold outside of this country, if the 4,000,000 and over pairs of hands that are now idle are to be given a chance to work and in turn purchase their share of goods. Fortunately the demand for our products exists and foreign buyers need American goods more than ever but credit, the foundation of all business, is almost hopelessly blocked by the great trade balance that has piled up in our favor as a result of the war.

Since the armistice we have received vast purchasing orders that would normally have been extended over a period of years in which case they could easily have been financed by the absorption of securities as practiced by England and other creditor nations. The result of this one-sided export business is that our commercial banks have reached the limit of their ability to extend credit, that the American dollar is at such a high premium in most foreign countries that it has become impossible for foreign buyers to do business with us except on the basis of long term loans and that we have taken all the gold that foreign countries can spare. Other countries still have excellent securities such as large stores of sugar, oil, mortgages, government bonds, etc., and several of our large corporations, including the United States Steel Corporation and the Bethlehem Steel Company, are helping the situation all they can by financing their foreign customers on a long term basis.

Independent financing, however, can only take care of a small percentage of our exports. More gold is neither attainable nor desirable, bartering is crude, subject to great risks and at best only an emergency measure, and most of all we cannot afford to take our pay in billions of dollars' worth

of manufactured products dumped into this country, when we can produce more than we need ourselves. It, therefore, remains for institutions like the Foreign Trade Financing Corporation and similar companies authorized by the Edge amendment to the Federal Reserve Act to finance their long term loans by issuing debenture bonds to the value of ten times their original capital. The \$100,000,000 Foreign Trade Finance Corporation alone would thus be able to use \$1,100,000,000, for the purpose of supporting the credit facilities of our foreign trade and by so doing provide work for the unemployed in this and other countries, insure us a steady market through its financial interest in foreign enterprises and return to us good interest on the money invested.

Millions of dollars' worth of export business is being lost through our present inability to finance our foreign trade on a long term basis and the manufacturers of one Middle Western state are losing \$20,000,000 in orders from south-eastern Europe alone. Purchasing agents for foreign buyers are here in greater numbers than at any time since the war, seeking credits for responsible firms in European countries, Japan, South Africa, South America and Australia for the purpose of buying our products. The great question is whether our country will back up our export business with the same concerted support that Great Britain has given to foreign trade not so much for the purpose of helping other nations, our merchant marine or special interests as to enable our great industries to return to a full time schedule with plenty of work for everyone.

Seaman's Act Handicaps Passenger Ships on the Great Lakes

THE difference between the summer and winter lifeboat accommodations required by the Seaman's Act for passenger vessels on the Great Lakes is so large that the profitable passenger navigation season is practically limited to the four months commencing May 15 and ending September 15. The steamboat men assert that the records of weather conditions of the Department of Agriculture show that this season may be safely extended six weeks to run from May 1 to October 15.

The number of lifeboats and rafts that a ship can carry depends largely upon the design of the vessel and Great Lakes steamers which are limited to comparatively small drafts, on account of the ports that they enter, cannot carry too much top hamper. While each vessel must be figured separately, the case of the passenger ship *See and Bee* which runs on the Cleveland-Buffalo route illustrates the great reduction in the number of passengers that she can carry between May 1 and May 15, and also between September 15 and October 15.

The *See and Bee* is equipped with fourteen 30-passenger lifeboats, two 20-passenger lifeboats and two 16-passenger lifeboats accommodating a total of 492 persons. Outside of the summer season, the law specifies that a sufficient number of lifeboats and rafts must be carried to accommodate every person on board and that 75 percent of this number must be taken care of by boats. The ship can then carry 164 more persons by providing the necessary rafts, which brings

the total sum to 656, but in order to man the ship a crew of 161 is necessary; which reduces the number of passengers to 495. In the summer season, however, the law specifies that accommodations for only 50 percent of the persons on board in lifeboats and rafts need be provided and of this number but 40 percent need be cared for by lifeboats. Thus her lifeboats take care of 492 persons as in the winter but she may provide raftage for 738 additional as compared with 164 in the winter. She thus provides rafts and boats for 1,230 persons; but as it is only necessary to carry this equipment for 50 percent of the people on board in the summer, she may take on a total of 2,460 persons. The size of the crew in the summer is increased to 186, which allows a total number of 2,274 passengers that may be carried between May 15 and September 15 as compared with 495 immediately before or after that period.

It is evident that no allowable reduction in crew or operating expenses can offset such a great reduction in passenger carrying capacity and there appears to be no apparent reason why the act should not be amended so as to include in the summer season the desired six weeks' extension as the law in its present shape has been a source of hardship and loss to Great Lakes operators for the last six years.

Shipbuilders' Claims

NOT the least of the many difficulties with which the Shipping Board has to contend, is the settlement of the huge claims held by the shipbuilding and shipping interests against the Government. The status and details of these claims are fully discussed in an article appearing on page 298 of this issue, which explains the vast amount of work and the procedure that must be taken before these obligations can be amortized.

The total amount of these claims now on record amounts to \$147,000,000, but there are still many others that have not been filed, which, together with the payments coming due for work that will be completed during the next year, will amount to many more millions. On the other hand, the amount of money that actually will be paid in these settlements will, probably, be scaled down through compromises and adjustments to a much lower figure than the total of the amounts claimed.

While we appreciate the difficulties that the Shipping Board must overcome in checking over the details of the almost numberless items in these claims before it can conscientiously make an award and the natural tendency of Congress to go slow in appropriating the necessary money, it seems too bad that the shipbuilders, including many of our best established yards, should have to wait for their money until their resources are so strained as to endanger their very existence.

There can be no doubt that the American people as well as Congress are convinced that an American merchant marine is absolutely necessary for our safety and prosperity, but it does seem as though every possible obstacle that can be placed in the way of our shipbuilders from the neglect to enforce the prospective protective measures of the Merchant Marine Act down to the decision that those who want to take a drink

on the ocean, which, curiously enough, includes many who are ardent prohibitionists at home, must take passage on a vessel flying a foreign flag. As Admiral Benson recently stated, if we want a merchant marine we must "aim steadily at it," but how are we to do this if the government makes laws which are not enforced and refuses to pay promptly its just debts to those interests that have had the courage to attempt to place the American flag on the high seas?

A New Transatlantic Service

ACCORDING to one of our English contemporaries "One of the most interesting developments this spring will be the inauguration of the new transatlantic service of the Royal Mail Steam Packet Company between Hamburg, Southampton, Cherbourg and New York." MARINE ENGINEERING has repeatedly pointed out the need for new passenger vessels flying the American flag and this new venture is only one more proof of the fact that foreign nations are perfectly willing to handle the passenger and fast freight trade across the Atlantic if we lack the facilities to do our share of the business. In addition to this, it is reported that the Royal Mail Company is figuring on establishing a new passenger service between the west coast of the United States and Europe, where there should be a particularly good field for bringing over immigrants and taking back food and fruit in refrigerated cargo spaces. The vessels scheduled for the Hamburg, Southampton, New York route are the *Orbita*, *Oropesa* and *Orduna* and the service is already advertised to commence May 2, with semi-monthly sailings thereafter. The *Oropesa* was launched at the yard of Cammell Laird & Company, Limited, Birkenhead, England, last December and she is a twin screw passenger and cargo vessel of the intermediate type, 552 feet in length, having a gross tonnage of 14,500 tons. There is no question of our ability to build this type of vessel, as we are now constructing a number of practically the same size, and it is to be hoped that the new administration will shortly fix on a definite shipping policy that will be liberal enough to inject some enthusiasm into the shipping interests in the matter of passenger ships.

Motorships

AMERICA leads the world in the percentage of ships in which the power is obtained from oil fuel, but in practically every case the oil is burned under boilers to generate steam instead of inside the cylinders of internal combustion engines. If our merchant fleet had been built under normal conditions instead of under the necessity of getting into the water in the shortest time possible the largest number of vessels that would be certain to operate smoothly, and for which qualified engineers were known to exist, it is more than probable that we would have had our share of motorships.

The world's supply of fuel oil is very limited, so much so that the Navy Department is very much concerned in securing and conserving adequate oil reserves for war vessels. The probability is that the cost of fuel oil will increase, if not in price then relatively through decreases in the cost of coal. As a general rule it may be stated in regard to oil or coal fired boilers that when twice the number of cents a gal-

lon of fuel oil costs is greater than the number of dollars per ton of coal, it is more economical to burn coal.

The amount of oil used in motorships, however, is only about 40 percent per shaft horsepower of that used in oil-burning steam installations and, aside from the fact that we ought to use our natural resources in the most economical manner, it is evident that motorships can run long after the price of oil for burning under boilers becomes prohibitive.

Mr. Frank Munson, president of the Munson Steamship Company, has advocated changing some of our Shipping Board vessels to motorships and there is no better time than the present when so many vessels are tied up to do this; but, unfortunately, Congress is not in the mood to appropriate money for shipbuilding. Several vessels are being converted to the electric drive method of propulsion and those that are finished are giving a good account of themselves. While Europe is going ahead with a large motorship programme we are allowing our country to get further and further behind in the construction of a type of vessel, the lack of which will make it harder for us to compete with the merchant marines of other countries.

Engineers for Political Positions

THE American Engineering Council of the Federated Engineering Societies in requesting President Harding to appoint an engineer as Assistant Secretary of War, and also to name an engineer for a vacancy on the Interstate Commerce Commission, was not seeking to further the interests of an individual group of men but rather suggesting a means of improving the administrative departments of the Government. Although lawyers have held a practical monopoly of political jobs, there are many positions that require very special qualifications, a large part of which are concerned with engineering.

The Navy, the Shipping Board and the Interstate Commerce Commission all employ a large number of men of engineering training and experience. The nature of the work handled by these departments is such that the preliminary exploration, construction, final survey, upkeep and operation require the services and knowledge of the engineer. Not only is this true of technical physical matters, but also in determinations of policy the judgment of the engineer should be more comprehensive and valuable than that of men of other professions.

The engineer as an executive would bring to investigations and deliberations a judicial mind trained to observe the inexorable laws of nature which are involved in the practice of his profession. In addition to his technical knowledge he should have executive experience gained through the direction of work under contract, an analytical method of thinking and a familiarity with the costs of construction and operation. The fact that the Executive Board of the American Engineering Council, of which Herbert Hoover is president, represents 150,000 American engineers may have some influence on the selection of engineers for executive positions in the future but, on the other hand, no body of men is better fitted either scientifically or practically to direct departments having to do with transportation and construction than members of the engineering profession.

 LETTERS TO THE EDITOR

Cost of Shipping Board Building Rentals in Philadelphia

MY attention has been called to an article in the February number of MARINE ENGINEERING by Mr. Waldon Fawcett under the caption "How United States Government Reorganization Will Affect The Merchant Marine." Inasmuch as this article contains incorrect and misleading statements pertaining to costs of building rentals in Philadelphia, I am taking this means of setting you right in this respect.

The portion of the article in question states, in effect, that the United States Shipping Board Emergency Fleet Corporation pays an "aggregate of \$472,000" for rent in Philadelphia and that this rental cost would be saved if all the offices were centralized in Washington. The article further implies that only a small part of this space is sub-leased to tenants and that such sub-tenants can "elect to vacate" at any time, thereby increasing cost of rentals to the Emergency Fleet Corporation. In view of this you will, no doubt, be interested in the following statement of facts:

The rent for the eleven story building at 140 North Broad Street, Philadelphia, which was leased in 1918, amounts to \$290,725 per year but the larger part of this has since been sub-leased (as space became available through curtailment of our program as a result of the ending of the war), the total revenues to the Emergency Fleet Corporation being \$379,977, or \$89,252 per year greater than the rental cost. However, after deducting our expenses of operation, there is a net cost to us of but \$18,748, and additional sub-leases now in process of negotiation will further reduce and may wipe out our rent cost entirely within a very short time. (We are operating this building for \$50,000 a year less than the bid we received from a private concern.)

The five floors of the building at 329 South Broad Street, Philadelphia, cost us \$78,000 for rent and maintenance, but sub-rentals amount to \$38,464.41, therefore the net cost to us is \$39,535.59 per year, but this building will be vacated by us at the expiration of our three year lease on May 5, this year, and this charge will therefore be eliminated.

The statement that the building at 253 North Broad Street costs \$32,000 for rent is correct, but the article neglected to state that we have sub-leased it for \$39,000 a year, thereby showing an excess of \$7,000 in receipts per year over costs.

Taking the \$18,748 net cost of rent at 140 North Broad, and the net cost of \$39,535.59 for 329 South Broad, makes a total cost of \$58,283.59. Deducting from this the clear profit of \$7,000 for 253 North Broad Street, leaves the actual cost to the Emergency Fleet Corporation \$51,283.59 per year, which is quite different from the "\$472,000" cost figure in the article. After May 5, this year, this cost will be reduced to \$11,748 per year, and may be wiped out entirely. As further evidence of the businesslike manner in which we handle our building matters, I will state that these costs for rent and operation in Philadelphia have been reduced from some \$500,000 per year (during the war emergency in 1918 when it required 4,500 people in our executive offices to direct the gigantic shipbuilding program in this country) to \$51,283.59 at present, and, as stated above, will be further reduced to \$11,748 within two months. The inaccuracy and injustice of the statements in the article referred to must therefore be apparent.

The statement that a building at 921 Delaware Avenue costs the Emergency Fleet Corporation \$95,000 for rent is hardly in accordance with the facts, as the Emergency Fleet Corporation does not occupy or hold the lease for these premises.

The Shipping Board also occupies some space for a branch

office at 802 Chestnut Street, but as the article made no mention of this these figures are not included here.

Our sub-tenants cannot "elect to vacate" and thereby increase our rental cost, as stated in the article, as their leases with us do not terminate until the expiration of our own leases.

In endeavoring to point out the savings which would be accomplished if "the entire staff and complete files of the Shipping Board and Emergency Fleet Corporation could be accommodated in the huge building at Washington," you do not appear to appreciate the necessity of the Shipping Board maintaining district and local offices such as are needed for ship operations, purchasing, finances, etc., the details of which no private concern would attempt to handle in one central office, as you will undoubtedly admit; nor do you seem to realize that the employees of the Shipping Board in Philadelphia are those connected with the Delaware River District offices, except some 250 constituting the Home Office of the Division of Construction and Repairs which remained here in order to wind up the construction program from the shipbuilding center of this country.

The above discrepancies in the article are called to your attention so that you can correct the misleading impressions resulting from it, as a matter of fairness. I feel quite certain that you had no intention of making misstatements about the Shipping Board rental costs in Philadelphia, but since you have made them, and as the matter of building operations is one of those coming under my jurisdiction I cannot let your article in this respect pass unchallenged.

W. J. BOLLENBECK,
Executive Assistant to the Director of Construction and Repairs, United States Shipping Board Emergency Fleet Corporation.
Philadelphia, Pa.

 NEW BOOKS

Packing for Export Shipment

EXPORT PACKING. By C. C. Martin, with chapters by M. C. Fitzgerald, manager of transportation, General Electric Company; D. T. Abercrombie, formerly Lieutenant-Colonel, U. S. Q. M. C., and H. N. Knowlton, formerly Captain, U. S. Q. M. C. Pages, 723. Illustrations, over 350. New York, 1921: *American Exporter*.

To all who are interested in the development of foreign trade, the new book on export packing just published by the *American Exporter* will be a real aid. It is the first book which not only tells but also shows how to pack for shipment abroad every type of commodity and it is illustrated with over 350 reproductions from photographs and drawings of successful packing methods furnished by scores of the most experienced exporting manufacturers in the country. Aside from its usefulness to exporters, this book contains much information applicable to the problems of domestic shippers, especially those who make use of coastwise lines.

The contents of the book are well arranged for constant reference. Chapters are devoted to the principles underlying the use of each type of container, such as cases, crates, bales, barrels, bundles, cartons, tins, etc. Other chapters are devoted to the packing methods employed in shipping all classes of goods overseas.

The author has enlisted the collaboration of well-known authorities on export packing, several of whom have written chapters on special subjects. The book likewise contains much excellent and practical information derived from such organizations as the Forest Products Laboratory, the Supply Service of the War Department and others devoted to the investigation and improvement of packing materials and methods.

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in this Department

CONDUCTED BY JAMES L. BATES

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Horsepower of River Steamer

Q. (1115).—We would appreciate it very highly if you could give us information based on the following data:

What would be the aggregate horsepower required to drive four propellers, 6 feet diameter, 9 feet pitch, each at the rate of 245 revolutions per minute? Or, with a given resistance of two pounds per ton of displacement at five miles an hour, what would be the horsepower required to drive 1,700 tons at the rate of 20 miles an hour?

The vessel under consideration is of the shallow draft type for service on the Mississippi River. The main characteristics of the vessel are as follows:

Length on load waterline.....	280 feet
Beam	40 feet
Draft	3 feet
Displacement	750 tons
Midship section coefficient.....	1
Designed speed, miles per hour.....	20
Number of propellers.....	4
Diameter of propellers.....	6 feet
Pitch of propellers.....	9 feet
Revolutions per minute.....	245

The stern is a long, very easy rake, becoming more round as it progresses from the bottom, which is absolutely flat. The bottom of the propeller blades will be one foot above the dead flat of the boat and have 6 inches to 1 foot clearance between the top and the stern of the boat. Owing to the easy stern, the water running to the wheels should be solid and should have easy access to the wheels. O. F. B.

A. (1115).—The intended use of your boat upon the Mississippi River system together with the high speed which you contemplate justify the coarse pitch and number of propellers referred to. However, the design of a boat to make a speed of 20 miles per hour (assumed to be statute, not nautical miles) through channels of restricted depth is, at best, a problem of some difficulty. Its satisfactory solution involves an accurate knowledge of the effective horsepower necessary to attain the desired speed as well as a knowledge of the possibilities and limitations of the propellers contemplated.

The following information, taken from the "United States Coast Pilot," section E, published by the Department of Commerce, is pertinent in this connection:

"Below New Orleans, channel depths average from 60 to 75 feet, with a minimum at low river stages of about 40 to 42 feet.

"Baton Rouge is accessible to vessels of the deepest draft at all seasons of the year.

"There is a 28-foot channel to Natchez and an 18-foot channel to Memphis.

"There are 9- and 8-foot channels to Cairo and St. Louis respectively at low river stages.

"There is a 4-foot channel to St. Paul at the extreme low river stage."

Experiments carried out at the Experimental Model Basin, Washington, D. C., some years ago indicate that for the shallow draft type of boat at moderate speeds a depth of channel of about 80 feet simulates closely deep water conditions in so far as propulsion is concerned.

Admiral Taylor in "Speed and Power of Ships," pages 117 and 118, states that the relative minimum depth for

which no increase in resistance occurs = $10 H \frac{V}{\sqrt{L}}$, in which

H = draft, V = speed in knots, and L = waterline length. He states further that this formula applies primarily to vessels of normal form having block coefficients up to .65 and

values for $\frac{V}{\sqrt{L}}$ not greater than .9. The extreme proportions

of river vessels in general and the high speed of this one in particular would seem to require a much greater channel depth to obtain the equivalent of deep water conditions than that given by the formula. A decrease to a 25-foot depth of channel does not seriously increase the power required for speeds below 8 or 9 knots (speed length ratios of .65 and .73 respectively), but at 13 knots the effective horsepower in the 80-foot channel is 365 as compared with 1,050 in the 25-foot channel. This increase of power with decrease in channel depth becomes even more serious at depths of 15 and 10 feet. These results are in general accord with results of similar experiments made elsewhere.

In view of these facts, the writer strongly urges that model basin experiments be carried out at channel depths corresponding to those which the boat is expected to encounter in service before the final details of either the hull or propellers are fixed. These experiments should be such as to furnish the curves of effective horsepower over the entire speed and displacement ranges contemplated. It would also be desirable, though not of the same importance, to try the model self propelled. It is believed that only by means of such experiments can the actual performance of the boat in service be satisfactorily forecast.

1	2	3	4	5	6	7	
$\frac{V}{\sqrt{L}}$	RESIDUAL		FRICTIONAL		Total E.H.P. Bare Hull	Speed, Knots	Speed, Miles
	Pounds per Ton Displacement	E.H.P.	Pounds per Ton Displacement	E.H.P.			
.4.....	1.28	19.8	4.72	72.8	92.6	6.7	7.71
.5.....	2.31	44.5	7.10	137	181.5	8.38	9.64
.6.....	3.21	74.2	9.83	227	301.2	10.05	11.56
.7.....	5.48	148	13.10	353	501	11.71	13.46
.8.....	9.46	292	16.74	516	808	13.40	15.40
.9.....	15.50	536	20.75	718	1,254	15.05	17.30
1.0.....	22.41	864	24.90	960	1,824	16.73	19.25
1.1.....	31.08	1,318	29.80	1,265	2,583	18.40	21.17
1.2.....	42.35	1,960	35.30	1,632	3,592	20.08	23.10

NOTE.—Column (3) = column (2) $\times$.00307 $\times V \times \Delta$. Column (5) = column (4) $\times$.00307 $\times V \times \Delta$. Column 6 = sum of columns (4) and (5).

Owing to the element of uncertainty introduced by a channel of varying though generally small depth, vessels designed for such service are frequently standardized and tried on a deep water course. On this account, and because the only data in the writer's possession which extend to the high speeds contemplated are for deep water, the following investigations have been carried out upon a deep water basis.

The derivation of the curve of effective horsepower, bare hull, is shown in the table at the bottom of the opposite page

with an explanation of the data in the several columns.

The above results are plotted for convenient use on Fig. 1. There is also shown on the same plate a curve for a channel depth of 15 feet derived from the same basic data as those used below. This latter curve is intended only to illustrate the cost in power of driving in very shallow water as compared to driving in deep water.

The following design of propeller is based upon the latest modified Dyson method:

FIRST TRIAL

$L.W.L. = 280 \text{ feet}$		$2 \times L.A.B.$	
$B = 40 \text{ feet}$		$\frac{\quad}{H_1} = 18.67$	
$H = 3 \text{ feet}$		$s = .18$	
$DS \text{ (tons)} = 750$		$1 - s = .82$	
$\frac{B}{L.W.L.} = .1429$		Type of vessel = 3	
$N.B.C. = .781$		$v = 20 \text{ miles} = 17.37 \text{ knots}$	
$K.B.C. = .71$		$e.h.p.B = 2,080$	
$H \div B = .075$		$\ddagger K = 1.36$	
$S.B.C. = .48$		$P \text{ feet} = 9$	
$*H_1 = 7.5$		$D \text{ feet} = 6$	
$\dagger L.A.B. = 70 \text{ feet}$		Number of blades = 3	
		Number of shafts = 4	

$\frac{PA}{DA} =$	.25	.30	.35	.4
$TS =$	5,981	6,766	7,630	8,516
$IT_D =$	2.73	3.73	4.81	6
$C =$	1	1	1	1
$I.H.P. = \frac{TS \times IT_D \times P \times D}{\pi \times 291.8 \times C} =$	962	1,486	2,161	3,009
$S.H.P. = I.H.P. \times .92 =$	885	1,351	1,988	2,768
$P.C. =$	.70	.68	.652	.62
$E.H.P. = I.H.P. \times P.C. =$	673.2	1,011	1,409	1,866
$E.H.P. \text{ (total)} =$	2,693	4,044	5,636	7,464
$V = \frac{(1-s) \times P \times TS}{101.33 \times D \times \pi} =$	23.11	26.14	29.48	32.91
$\frac{v}{V} =$	.7517	.6644	.5892	.5278
$\frac{e.h.p.}{E.H.P.} =$	.7726	.5144	.369	.2786
Cavitating =	No	No	Yes	Yes
$Z_p =$	.117	3		
$10^2 p =$	1.309	1.995		
$S.H.P. \text{ (total)} =$	3,540	5,404		
$S.H.P._p = S.H.P. \div 10^2 p =$	2,704	2,708		
$S.H.P._a = S.H.P._p \times K =$	3,678	3,684		
$Z_s =$	.268	.42		
$10^2 s =$	1.854	2.630		
$S = \frac{S \times S.H.P._a}{S.H.P.} \times 10^2 s =$	.3467	.3227		
$1 - s =$	.6533	.6773		
$R_a =$	299	289		

* Height of tunnel roof above baseline at position of propeller.

† Length along keel from opening of tunnel at forward edge to position of propeller. From investigations of similar vessels, this distance was found to be about 25 percent of $LWL = 280 \times .25 = 70 \text{ feet}$.

‡ A constant for this class of vessel. Includes appendage resistance.

It will be seen from the above calculations that with a diameter of 6 feet and a pitch of 9 feet a standard form of propeller blade up to .3 projected area ratio results in revolutions much above the 245 desired. It will also be seen that to increase the projected area ratio above .3 throws the propeller into cavitation.

The next step is to design a four-blade propeller, having what is known as a "fan shaped" blade. A "Basic" diameter (D^1) will be assumed and with this diameter together with

the final "Basic" projected area ratio $\left(\frac{PA}{DA}\right)^1_4$ blades may

be drawn of the standard Dyson form, the tips cut off to the desired diameter of 6 feet and the removed area added to the sides as far out toward the circumference as possible. The projected area of the resulting propeller will be the same as that of the calculated "Basic" propeller. The contour of the "Basic" propeller blades should conform to the Dyson standard blade shape corresponding to the three (3) blade projected area ratio $\left(\frac{PA}{DA}\right)^1_3$

ected area ratio $\left(\frac{PA}{DA}\right)^1_3$

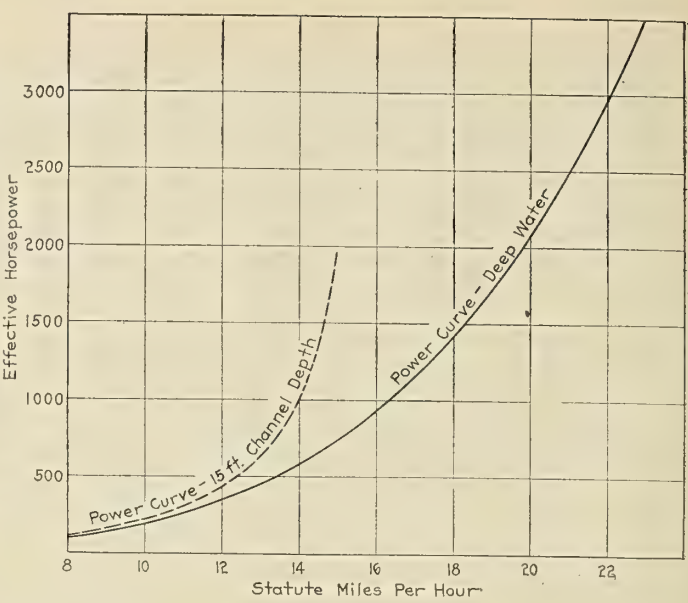


Fig. 1

SECOND TRIAL

$\left(\frac{e.h.p.}{E.H.P.}\right)_{PE} =$	.3	.4	.5	.6	.7
$Z_{PE} =$	.5445	.4144	.313	.231	.1613
$\text{Log } K =$	.13354	.13354	.13354	.13354	.13354
$Z_p = Z_{PE} + \text{log } K =$	.67804	.54794	.44654	.36454	.29484
$\frac{e.h.p.}{E.H.P.} =$	.223	.300	.371	.445	.52
$e.h.p. =$	2,080	2,080	2,080	2,080	2,080
$E.H.P. \text{ (total)} = e.h.p. \div \frac{e.h.p.}{E.H.P.} =$	9,328	6,934	5,607	4,674	4,009
$E.H.P. \text{ (one shaft)} = E.H.P. \div 4 =$	2,332	1,733	1,402	1,169	1,000
$v =$	17.37	17.37	17.37	17.37	17.37
$\frac{v}{V} =$	.652	.714	.771	.822	.869
$V = v \div \frac{v}{V} =$	26.64	24.33	22.53	21.13	19.99
$C =$	2.491	2.491	2.491	2.491	2.491
$D \text{ (Basic)} =$	7.0625	7.0625	7.0625	7.0625	7.0625
$\frac{PA}{DA} \times ET_p = \frac{E.H.P. \times C}{(D^1)^2 \times V} =$	4.389	3.571	3.12	2.774	2.508
$\left(\frac{PA}{DA}\right)^1 =$	.39	.334	.301	.277	.260
$\left(\frac{PA}{DA}\right)^1_4 = \frac{4}{3} \left(\frac{PA}{DA}\right)^1 =$	.5199	.4453	.4013	.3693	.3467
$P.C.^1 =$	.5445	.59	.618	.64	.6545
$I.H.P.^1 = E.H.P. \div P.C.^1 \text{ (one shaft)} =$	4,283	2,937	2,268	1,826	1,528
$I.H.P.^1 \text{ (total)} =$	17,130	11,748	9,072	7,306	6,111
$S.H.P.^1 \text{ (total)} = I.H.P. \text{ (total)} \times .92 =$	15,760	10,808	8,346	6,721	5,622
$Z_p =$	.679	.5445	.447	.366	.294
$10^Z_p =$	4.7753	3.5035	2.799	2.3225	1.968
$S.H.P.^1_p = S.H.P.^1 \div 10^Z_p =$	3,300	3,085	2,982	2,894	2,865
$S.H.P.^1_a = S.H.P.^1_p \times K =$	4,488	4,196	4,055	3,936	3,897
$S.H.P.^1_a = S.H.P.^1_a \times \frac{D^1}{D} =$	5,283	4,938	4,773	4,633	4,587

	TS = 8,330	7,360	6,795	6,400	6,125
$P = \frac{V \times \pi \times D^1 \times 101.33}{(1-s) \times TS} =$	8.770	9.064	9.092	9.053	8.95
$Z_s =$	.445	.332	.236	.160	.094
$10^3 =$	2.7864	2.1479	1.7214	1.4452	1.2416
$S = \frac{S \times S.H.P.^{1/4}}{S.H.P.^1} \times 10^3 =$	.1428	.1501	.1505	.1523	.1549
$1-s =$	.8572	.8499	.8495	.8477	.8451
$R^1_a = \frac{v \times 101.33}{P \times (1-s)} =$	234.1	228.5	227.8	229.3	232.7
$R_a = R^1_a \times \left(\frac{D^1}{D}\right)^{3/2} =$	254	247.9	247.2	248.8	252.5

The characteristics of the propeller selected would be:

- Basic diameter = 7 feet 3/4 inch
- Actual diameter = 6 feet 0 inch
- Pitch = 9 feet 1 inch

$\left(\frac{PA}{DA}\right)^1$ projected area ratio, "Basic" = .4013

$\left(\frac{PA}{DA}\right)$ projected area ratio used in laying out blade forms = .301

$\left(\frac{PA}{DA}\right)$ projected area ratio, actual = .556

Actual projected area = 15.72 square feet

S.H.P., total about = 4,770

R.P.M., about = 247

While these characteristics do not exactly meet the requirements which you laid down, they are very close, and as the result of a number of trails, not tabulated herein, are believed to represent as satisfactory a solution of the problem as can be reached without the aid of model experiments.

The steps have been set down in detail above, as it is felt that the results themselves are of more value when the method of their derivation is available for reference.

Attention is particularly invited to the fact that the power given is net, no margins of any kind having been introduced.

Subsequent to the completion of the above work, propeller investigations on another vessel indicated the possibility of designing a better propeller for this ship than that above described. An investigation along the lines indicated below resulted in the design of such a wheel.

Assume a three (3) bladed propeller, having what is known as a "fan shaped" blade. "Basic" diameter (D¹) assumed and with this diameter together with the final

"Basic" projected area ratio $\left(\frac{PA}{DA}\right)^1$ blades may be

drawn of the Dyson standard form, the tips cut off to the desired diameter of 6 feet and the removed area added to the sides as far out toward the circumference of the 6-foot blade as possible. The projected area of the resulting propeller will be the same as that of the calculated "Basic" propeller. The contour of the "Basic" propeller blades should conform to the Dyson standard blade shape corresponding to the projected

area ratio $\left(\frac{PA}{DA}\right)^1$

Upon this basis the propeller characteristics and performance are:

Basic diameter.....	7 feet 0 inches
Actual diameter.....	6 feet 0 inches
Pitch	9 feet 8 inches

$\left(\frac{PA}{DA}\right)^1$ Projected area ratio used in laying out blade forms.....	.304
Projected area ratio, actual.....	.4137
Actual projected area in square feet.....	11.7
S. H. P. (total).....	4,300
R. P. M.	245

Stealer Plates

Q. (1120).—An argument having arisen as to the term applied to the plates in Fig. 1, marked with a question mark, I wish to have your counsel on the matter. A contends that the plates in question are called stealers, while B contends that they are short strakes and that the plate of the strake marked X is the stealer. We have looked up all reliable sources of information that we can procure and can find no definite information. C. G. B.

A. (1120).—The distinguishing feature of a stealer plate is its taking the place of two plates in adjacent strakes or its forming the ending of one strake while at the same time continuing the adjacent strake. The stealer plate is sometimes

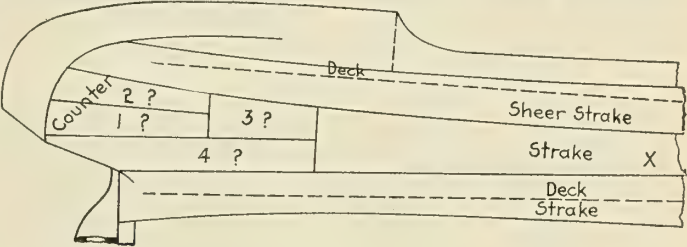


Fig. 1

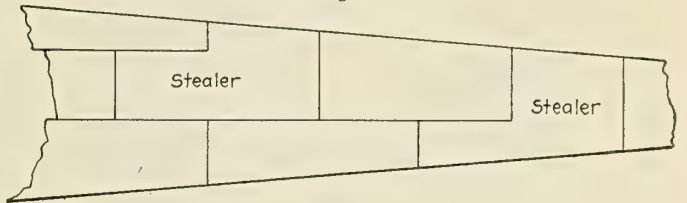


Fig. 2

worked as shown in Fig. 2, rather than as in your sketch, in order to secure a more effective shift of butts. In any case, however, the change in the total width of the plated surface, whether in the forward or after part of the vessel, is the occasion for the introduction of the stealer.

In Fig. 1 the strakes are narrowing from the counter forward. In accordance with the foregoing, therefore, strake 4 and either 1 or 2 are drop strakes and the aftermost plates of strakes 3 and X are stealers.

Official figures of the Board of Trade covering the entrance and clearance of vessels with cargo at British ports in 1920 show an increase of nine million tons net over similar returns for the year 1919, and a gain of almost 24 million tons over the figures for the year 1917. Of the total entrances and clearances in 1920, approximately 49 million tons were British ships.

PERSONAL MENTION

PAUL H. MACNEIL, dry dock engineer, has severed his connections with the Crandall Engineering Company, East Boston, Mass., and has accepted the position of dockmaster with Theo. A. Crane's Sons Company, Brooklyn, N. Y. Besides the three existing floating dry docks at this plant, a new 12,000-ton floating dock is rapidly nearing completion. This added facility, coupled with the acquiring of adjacent land until recently occupied by Gokey & Company, will make of the Crane Company one of the largest and best equipped repair and dry dock plants in the port of New York.

JOHN HUNTER, the well-known power plant engineer, who as was announced in our last issue has just accepted the position of chief engineer of the Heine Safety Boiler Company, was born in Scotland, where he was educated and served his engineering apprenticeship. He entered the marine service as junior engineer on the Red Star Line S. S. *Westernland*. Later he was promoted to first assistant engineer on the S. S. *Friesland* of the same line. In 1895 he was transferred as senior first assistant engineer to the S. S. *St. Louis* of the American line, then being built at Cramp's shipyard in Philadelphia. He served in this capacity until the outbreak of the Spanish



John Hunter

American War in 1898, when he was appointed chief engineer of the *St. Paul*, operated by the United States Navy, with Captain Sigsbee in command. When the *St. Paul* was returned to commercial service between New York and Southampton he continued as chief engineer. In August, 1905 Mr. Hunter accepted the position of chief engineer of power plants of the Union Electric Light & Power Company, St. Louis, where he had charge of the design, construction and operation of the electric generating stations of the company, which supplied practically all the lighting, industrial power, as well as a considerable share of the street railway power used throughout the city. The largest station of this system, the Ashley Street Station, was the scene of much pioneer development work. For instance, when Mr. Hunter assumed charge of the plant it was rated at 12,000 kilowatts, and in the same building by the adoption of ultra-modern improvements he increased the power to 116,000 kilowatts. During this period he had much to do with the pioneer development of high capacity turbine units, condensers, improved methods of setting boilers and designing furnaces for high capacity and forced operation. In 1913 he was associated with Mr. Hugh L. Cooper, of the Keokuk Water Power Company, in the building of the hydro-electric plant, which when completed furnished the Union Electric Company in St. Louis with 45,000 kilowatts transmitted at 100,000 volts. In 1917 Mr. Hunter was called East by the United States Government to assist in the shipbuilding program. He was first detailed as Government representative in charge of the Submarine Boat Company, and later transferred to the Standard Shipbuilding Corporation, Shooters Island, N. Y. Under his supervision the number of employees was increased from something over 400 in 1917, to approximately 4,500 at the time the armistice was signed.

During the war this yard completed twenty-five 7,500 deadweight ton cargo boats, two mine sweepers, two fruit and passenger steamers, and they now have nearing completion four 8,400 deadweight ton oil tankers. Mr. Hunter has served seven years as a member of the prime movers' committee of the National Electric Light Association, and five years as a member of the American Uniform Boiler-Law Society. He is a past president of the Engineer's Club of St. Louis, and was a member of the jury of awards, Department of Machinery, at the San Francisco Exposition. In the American Society of Mechanical Engineers he was member of the Council as manager for three years, and as vice-president for two years. Mr. Hunter has a host of friends in the central station and power plant field who will welcome his entry into a position where he can bring his experience to bear on the design and operation of central stations throughout the country.

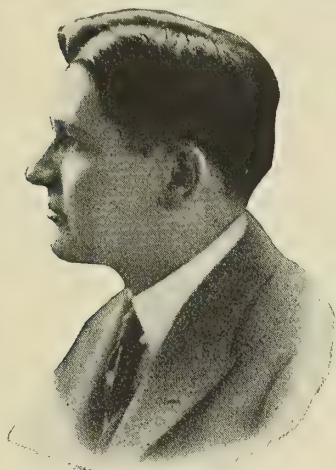
DAVID CURRIER, JR., sailed from New York on March 5, for Buenos Aires, Argentina, where he will take up the duties of exclusive surveyor for the American Bureau of Shipping for that port and also with supervision over the ports of Rosario and Montevideo. Mr. Currier is a graduate of the engineering department of Brown University with special training in naval architecture at the Massachusetts Institute of Technology. After graduation he served an apprenticeship as a ship fitter in the yards of William Cramp & Sons Ship and Engine Building Company, Philadelphia. Since that time he has been engaged as a draftsman, inspector and purchasing agent at several of the leading shipyards in the country. He has also had service at sea in the engine room of one of the Hog Island ships. The business of the American Bureau of Shipping at River Plate ports has increased to such an extent that it was deemed advisable to have an exclusive surveyor located in that vicinity. Capt. L. A. Blake, of Maine, heretofore non-exclusive surveyor at Buenos Aires, will be retained in the same capacity to act as such times as his services are necessary.

G. NORMAN SCOTT, formerly chief engineer of the Standard Shipbuilding Corporation, Shooters Island, New York, is president of Scott Brothers & Surtees, Inc., Whitney Central Building, New Orleans, La., a new company which has been formed to carry on the business of consulting engineers, naval architects and marine surveyors. For some years past Mr. Scott has been identified with American shipbuilding at the yards of the Chester Shipbuilding Company, Chester, Pa., and of the Standard Shipbuilding Corporation, Shooters Island, New York. He was chief engineer of both companies and at the Standard yard for some time had complete charge of both hull and engine work. Mr. Scott received his early training at the Glasgow Technical College and in the shipyards of Messrs. Alex. Stephens & Sons on the Clyde, after which he had a number of years actual sea experience before coming to America. The new firm in New Orleans will be associated with the old established firm of Scott & Surtees, 80 Broad Street, New York, and will handle work all along the Atlantic and Gulf coasts.



G. Norman Scott

M. F. EMRICH, formerly vice-president and general manager of the Campbell Paint and Varnish Company, St. Louis, Mo., a subsidiary of the Glidden Company, has recently been appointed general sales manager of the Industrial Division



M. F. Emrich

of the Glidden Company, with headquarters at Cleveland, Ohio. Mr. Emrich has been connected with the Glidden Company for many years in various capacities. His experience covers every phase of the paint and varnish industry. During his many years of service with the Glidden Company he has shown exceptional ability and has advanced steadily. In the Industrial Division are experts not alone on proper marine finishes but on the method of application as well. It is confidently expected that in his new capacity Mr. Emrich will develop the Industrial Division to an even greater extent than ever before.

CHARLES H. TRUE has been elected vice-president of The Superheater Company, in charge of production, with offices at East Chicago, Ind. Mr. True was born in Boston, Mass. He was educated at the public schools of Schuyler, Neb., and the University of Nebraska, graduating in 1898, with the degree of electrical engineer. Immediately upon graduation he entered the service of the Union Pacific Railway, at Omaha, and served in both the locomotive and car shops. In 1902 he became round-house foreman at Grand Island, Neb., and in 1903 resigned from the Union Pacific to take a similar position at Trenton, Mo., with the Chicago, Rock Island & Pacific Railway. In October of the same year he was transferred to the Silvis shops as assistant superintendent of shops. In 1905 he accepted the position of mechanical engineer with the Railway Materials Company at Chicago and was engaged in the design of metallurgical furnaces for blacksmith shops and boiler shops. In 1910 he refitted and took charge of the Phoenixville, Pa., plant of this company. In 1912 he resigned his position with the Railway Materials Company to become works manager of the Locomotive Superheater Company at East Chicago, Ind., which position he held at the time of his recent election to the vice-presidency. During the time he was works manager he was actively associated in the mechanical development of superheaters for locomotive, marine and stationary boilers. Mr. True is a member of the American Society of Mechanical Engineers and other engineering societies.



C. H. True

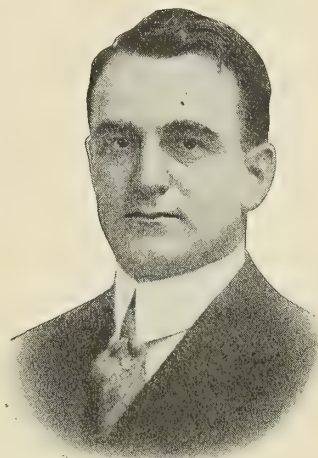
HENRY B. OATLEY was recently elected vice-president in charge of engineering of The Superheater Company, with offices at 30 Church street, New York. Mr. Oatley was born at Rochester, N. Y., and attended the public schools at that place. He received his engineering education at the University of Rochester and the University of Vermont, graduating from the latter in 1900 with the degree of mechanical engineer. Upon graduation he entered the service of the Schenectady Locomotive Works. His experience while on this work was very broad, embracing locomotive design and shop testing. He was associated with F. W. Cole in the early development of the superheater for locomotives by that company. In 1910, upon the formation of the Locomotive Superheater Company, he accepted the position of mechanical engineer, and in 1916 was appointed chief engineer for this company, which position he held at the time of his election as vice-president. In April, 1917, he was granted a leave of absence and served as an officer in the United States Navy on the battleships *Ohio* and *Indiana*. Mr. Oatley is a recognized authority on superheating, and has been an active factor in its development. He is in a large measure responsible for putting superheater design upon a practical operating and manufacturing basis in locomotive, marine and stationary practice, and without sacrifice to efficiency has developed uniformity of sizes and design.

GILBERT E. RYDER has been elected vice-president of The Superheater Company, in charge of sales, with office in New York. He was born in Minneapolis, Minn., in 1880. He studied engineering at the University of Wisconsin and also at the University of Illinois. His railroad experience began with apprenticeship on the Chicago, Milwaukee & Saint Paul Railway and included service as a journeyman in the mechanical department of that road at Dubuque, Ia., Ottumwa, Ia., and West Milwaukee, covering five years. Engineering experience followed in the fuel testing bureau of the technologic branch of the United States Geological Survey. He later served the city of Chicago as deputy smoke inspector in charge of locomotives, which placed him again in intimate contact with the locomotive fuel conservation problem. This was followed by editorship of the *Railway Review* of Chicago, after which he entered the service of the Locomotive Superheater Company ten years ago. He became a member of the service department and later took charge of that department, which today is responsible for the operation of 30,000 superheaters on locomotives in this country alone, in addition to stationary and marine applications.



H. B. Oatley

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G. E. Ryder

Shipbuilding and General Marine News

Contracts for New Ships — Shipyard Improvements —
Engineering Projects—Improved Appliances—Personal Items

EQUIPMENT ASSOCIATION OF AMERICA ORGANIZES PERMAN- ENT BODY FOR MARINE FIELD

Object is to Advance Interests of Members—Is 100 Percent American
and Favors Adequate Merchant Marine for America—
Holds First Election of Officers

A meeting of the Marine Equipment Association of America, for the purpose of forming a permanent organization, was held at the Hotel McAlpin, New York, on March 28.

The object of this association is to advance the interest of its members; to promote good will among those who specify, those who buy and those who sell marine equipment, supplies and stores; to promote and supervise marine exhibitions; to co-operate with other associations in the marine field, to the end that their efforts for the advancement of designing, building and operating ships shall be most productive. This organization is 100 percent American, and favors an American merchant marine of adequate size to meet the commercial and military needs of the country. One hundred and thirty-nine concerns have already signified their intention of joining the association and 75 representatives were present at this meeting.

The officers elected were, as follows:

President—Col. E. A. Simmons, president, Simmons-Boardman Publishing Company, New York.

Vice-President—W. H. Todd, president, Todd Shipyards, New York.

Secretary and Treasurer—K. L. Ames, Jr., American Steel Foundries, Chicago, Ill.

EXECUTIVE COMMITTEE

E. B. Williams, B. F. Sturtevant Company, Boston, Mass.

F. L. Andrews, general manager, Hyde Windlass Company, Bath, Me.

M. L. Katzenstein, Worthington Pump & Machinery Corporation, New York.

Walter M. McFarland, general manager, Babcock & Wilcox Company, New York.

H. C. Davis, Row & Davis, New York.

Frank Hatch, vice-president, Shepard Electric Crane & Hoist Company, Montour Falls, N. Y.

H. R. Stephen, vice-president, Submarine Boat Corporation, Newark, N. J.

G. W. Selby, president, Marine Decking & Supply Company, Philadelphia, Pa.

J. C. McQuiston, director of publicity, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

W. P. Smith, William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa.

William Stayton, president, Baltimore Steamship Company, Baltimore, Md.

F. C. Bradbury, Crane Company, Chicago, Ill.

M. Sarles, Pyle-National Company, Chicago, Ill.

H. L. Hibbard, Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

J. H. Redhead, National Malleable Castings Company, Cleveland, Ohio.

H. F. Alexander, president, Pacific Steamship Company, Seattle, Wash.

W. M. Wampler, Coen Company, San Francisco, Cal.

TO BUILD TANKERS

Report Contract Placed for Six Ships Costing \$15,750,000

The contracts for the Diesel motor equipment to be installed in the six tankers proposed to be built by the Norway Pacific Construction & Dry Docks Company, in Everett, Wash., have been awarded to the American British Manufacturing Company, Bridgeport, Conn., and Providence, R. I., according to announcement credited to M. G. Thomle, president of the company, and received by Marine Engineering.

Arrangements for pumps and piping have been made and steel orders have been placed in the East. The beginning of work on the six tankers, which Mr. Thomle says have been contracted for, will await the return to Seattle of M. E. Barham, receiver of the yard, now in the East completing financial arrangements.

Half of the funds will be provided by foreign capital, it was stated, and the remainder in this country. The yard at Everett is fully equipped, and \$150,000 will be spent in making the three ways ready for work, the contract to be completed in 1922.

It was estimated that the six tankers, the ownership of which has not yet been announced, will involve approximately \$15,750,000.

ELECTRIC DRIVE CONTROL

Disaster Averted by Invincible's New Equipment

An account of the recent collision between the Army Transport *Madawaska* and the U. S. Shipping Board vessel *Invincible* has just been obtained from Commander V. V. Woodward, Manager of the Repair Department of the U. S. Shipping Board and Mr. H. B. Taylor, chief turbine engineer of the Shipping Board.

The *Invincible* had just been equipped with the electric drive and was bound for Norfolk for cargo. Commander Woodward and Mr. Taylor were aboard to note the performance of the equipment on the initial trip. They had just come up from the engine room and were standing on the bridge when the *Madawaska* was first sighted, about a ship's length away. The weather was extremely heavy and the *Invincible* was running at a reduced speed of about 6 knots. As soon as the *Madawaska* was sighted, full-speed astern was rung from the bridge and in three seconds from the time that the signal was answered in the engine room, the *Invincible's* propeller was turning up 100 revolutions full speed astern.

They state that the only thing that prevented the accident from being much more serious was the rapidity of control of the electric drive, as when the ship struck, the *Invincible's* motor was reversed and going full-speed astern.

Fruit Steamer Has Successful Trial

The twin screw steamer *Choluteca* after a very successful trial trip upon which she developed a speed of 15 knots was delivered March 11th by the Newburgh Shipyards, Inc., of Newburgh, N. Y., to the Cuyamel Fruit Company of New Orleans, La.

This vessel, which is 301 feet 6 inches in length, 42 feet broad and 24 feet 10¾ inches molded depth, is of the shelter deck type with steel upper deck all fore and aft and is designed expressly for the carrying of bananas between Puerto Cortez and New Orleans, having a deadweight carrying capacity of 2,100 tons on 16 feet 6 inches mean draft.

The machinery consists of two sets of reciprocating engines, each developing 1,500 indicated horsepower.

Shipping Board Finances

In a report to the Senate written by Commissioner Teal, it is stated \$395,000,000 will be needed by the Shipping Board for its various activities during 1921, including completion of its construction program. A deficit from operations of \$38,000,000 is expected in the first six months of this year as compared with a profit of \$25,000,000 in the last six months of 1920. Commissioner Teal recommends a direct or indirect subsidy.

Peak of Depression at Hand

Shipping Board officials assert that withdrawals of vessels from operation are decreasing and that assignments are increasing. They expect the peak of the depression to be over in about two or three weeks.

TANKERS PREDOMINATE IN MILLION AND A HALF TONNAGE NOW UNDER CONSTRUCTION

American Bureau of Shipping Figures Show 101 Tank Ships Ordered or Under Way, 94 of Which Are for Private Owners—330 Merchant Ships Building

Construction of tankers is much greater proportionally for work now under way for private account than that for the Shipping Board, according to returns compiled by the American Bureau of Shipping. It is estimated that more than half of all the steel merchant tonnage under construction in American shipyards at the beginning of this month represent the tanker type of vessel.

Ships of all types building for both Government and private account at the beginning of the month aggregated 330 of 1,434,146 gross tons of which 54 boats totaling 435,412 gross tons were for the account of the Shipping Board and 276 of 998,834 gross tons were for private owners. The Government's construction work in hand, therefore, has now reached the point where it is considerably less than half the building for private account. The division of the work under way by types of ships is as follows (figures being in gross tons):

	Shipping Board	Private Account
Tankers	51,000	720,093
Freighters	195,412	278,741
Passenger and cargo...	189,000	
Total	435,412	998,834

Practically all of the vessels building are being constructed either to burn oil alone or so that they can be converted from oil to coal burners.

Tankers ordered or under way totalled 101 of 756,354 tons. Seven of 51,000 tons were for the Shipping Board and 94 of 705,354 tons for private owners. In addition 30 unpropelled oil-carrying barges of 14,739 tons were under way, all on private account.

Cargo ships ordered or under way totalled 95 of 432,078 tons, 66 of 236,666 tons being on private account. In addition 86 barges of 42,075 were under way, all on private account. Of the freighters 53 of 252,591 tons were fitted with oil burners and 26 of 169,565 equipped to burn either oil or coal. Combination passenger and cargo liners building or ordered totalled 18 of 189,000 tons, all on Shipping Board account.

Ten Above 10,000 Tons

Of ships building or ordered eight of 108,000 total tonnage were between 13,000 and 14,000 gross tons, two of 21,200 total were between 10,000 and 11,000 tons; seven of 69,000 total between 9,000 and 10,000 tons, 21 of 183,494 between 8,000 and 9,000, 21 of 158,277 between 7,000 and 8,000 and 28 of 183,894 between 7,000 and 8,000.

Six freighters of 30,100 total tonnage and four tankers of 30,700 tons were to be equipped with Diesel engines, 29 cargo ships of 183,800 tons and five tankers of 36,000 tons were to have steam turbine drive, while 56 freighters of 190,098 tons and 94 tankers of 690,904 tons were to have reciprocating engines. Of the passenger and cargo liners three were to have reciprocating engines and 15 turbines.

Out of the 326 ships under way or ordered, 84 have not yet reached keel laying. Out of 383 ways in American yards in operation 154 ways were empty March 1.

Bethlehem Plant in Lead

Bethlehem Shipbuilding led with 31 ships of 264,900 gross tons ordered and under way at its five plants. Eight of these ships have not yet reached keel laying. Out of its total of 45 ways 22, or approximately half, were idle.

New York Shipbuilding was second with 20 ships of 183,600 tons ordered and under way. Out of its 22 ways only 2 were idle.

Federal Shipbuilding was third with fifteen ships of 110,000 tons ordered and under way at its Chickasaw and Kearny plants. Out of its twenty-two ways seven were idle. Sun Shipbuilding was fourth with eleven ships of 93,199 tons ordered and under way. All eight of its ways being filled and three of the ships not as yet to keel laying.

Moore Shipbuilding was fifth with ten ships of 73,439 tons under way and all ten of its ways filled. Merchants Shipbuilding came sixth with ten ships of 67,140 tons on the ways and two of its ways idle, while Newport News Shipbuilding came seventh with five ships of 58,700 tons under way and three of its eight ways idle.

West Coast Shipping Improves

Although there is some pessimism among the shippers and steamship operators at Seattle and other Pacific ports, shipping has been improving gradually since the first of the year. In the intercoastal trade several new lines have come to Seattle since January, and still there is enough cargo to be had for all the carriers dispatched from Puget Sound and Columbia River. In more than a half dozen cases the coast-to-coast freighters have had to leave tons of cargo behind because their holds were filled.

CANADIAN INDUSTRY

Millions of Dollars Invested in Shipbuilding Business

The Canadian ship and boat building industry, which received such an impetus during the war, represented a total investment of \$72,000,000 in 1919, according to the Dominion Bureau of Statistics. Of this amount \$70,854,028 was invested in shipbuilding plants, nine-tenths of which turned out steel vessels. At the outbreak of war there were only two thoroughly up-to-date steel shipbuilding plants in Canada but at the end of 1919 there were nineteen.

The report divides the plans into shipbuilding and boatbuilding but does not subdivide the former into those which turn out steel and wooden vessels respectively. In 1919 there were 78 shipbuilding plants distributed among the provinces as follows: British Columbia, 14; Manitoba, 1; New Brunswick, 4; Nova Scotia, 37; Ontario, 11; Quebec, 11. In the Maritime Provinces the plants have been small, though in 1920 that of the Halifax Shipyards, Limited, a thoroughly modern steel plant, began turning out steel vessels. The number of boatbuilding plants in all Canada was returned as 99.

The capital investment of \$70,854,028 in shipbuilding plants was divided as follows: Ontario, \$29,911,885; Quebec, \$27,614,498; Nova Scotia, \$8,732,419; British Columbia, \$6,541,003; New Brunswick, \$54,223. Ontario with an investment of \$680,493 is the center of the boatbuilding industry. The total number of employees in all branches of the industry in 1919 was 28,000, of which 25,260 were in shipbuilding plants, the total wages and salaries paid in that year being \$30,750,000.

The total cost at the works of materials used in 1919 was \$36,500,000, the total value of all products of the yards being \$88,300,000. In this connection it may be said that included on this figure is \$9,176,000 for vessels built but not launched, also repairs valued at \$8,282,000. The number of vessels completed during the year was 281, the gross tonnage being 3,604,539.

In 1919, the value of vessels exported was very large, the figures for the nine months ending December being \$36,752,184 as compared with \$15,280,494 for the same period in 1918. During the nine months ending December, 1920, the value of these exports had fallen to \$16,832,468.

Bethlehem Corporation to Have Busy Year

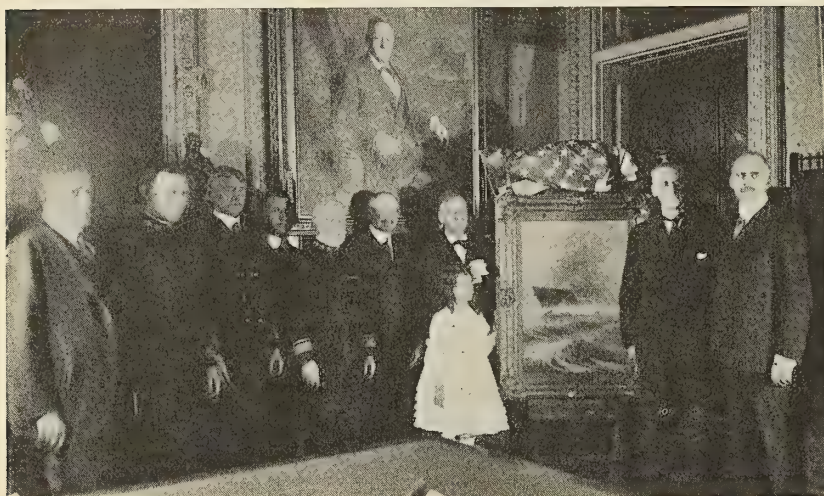
Orders for new construction on hand will keep the principal shipbuilding plants of the Bethlehem Steel Corporation well employed during the current year, according to Charles M. Schwab, chairman of the Board of Directors of this corporation. In his statement, Mr. Schwab says that in the business readjustment representatives of the employees of the corporation have met the managers in a fair and co-operative spirit. According to Mr. Schwab the value of unfilled orders on December 31, last, was \$145,286,637, as compared with \$251,422,545 on December 31, 1919.

Australian Shipping Strike Ended

The shipping strike in Australia has ended, the men's leaders having adopted a conciliatory attitude, and are anxious that work should be resumed immediately. Ships will be named at the earliest possible moment. The differences regarding manning were decided by a joint committee, the unions giving pledges of continuity of employment and the abandonment of attempts to control appointments. It was also agreed that the settlement of disputes should be by constitutional means.

DEVELOPMENT OF STEAM TURBINE ELECTRIC DRIVE SHOWS NOTABLE PROGRESS

President of General Electric Company Presents Navy Department With
Portrait of The "New Mexico"



A magnificent specimen of sea and ship portraiture, a canvas of the first electrically driven battleship in the world, the *U. S. S. New Mexico*, was presented to the United States Navy Department by E. W. Rice, Jr., president of the General Electric Company, on February 28. It was accepted by Secretary Daniels.

This painting, pronounced by Rear Admiral W. S. Benson, head of the U. S. Shipping Board, the finest he had ever seen, was executed by Walter L. Greene, artist of the Publication Bureau of the General Electric Company.

In presenting the picture to Secretary Daniels, Mr. Rice said:

"Mr. Secretary of the Navy and Gentlemen:

"The Navy Department of our Government has contributed more to important advances in engineering than is generally appreciated by many well-informed people.

"I will not attempt even to mention the numerous developments which the navy has either stimulated or originated, but I do wish to briefly outline one of the big forward steps of recent years in which the navy has played a great and indispensable part, namely the development of the steam turbine electric drive for ships. This new system is of prime importance and value to our country, not only because it has resulted in placing our naval vessels and equipment in a highly satisfactory position of leadership, but because it has also pointed the way to the use of the electricity in propulsion of our merchant marine.

"I do not believe that it is possible to exaggerate the importance of the general introduction of electricity on ships of all kinds, including, as the final achievement, the operation of the driving machinery.

EMMET GIVEN CREDIT

"It must be a great satisfaction to every

man to remember that the modern steam turbine electric drive for ships largely resulted from the work of a graduate of our great naval academy at Annapolis, W. L. R. Emmet, who with a thorough understanding of the principles involved, attacked the problem and with patience and perseverance continued to overcome all obstacles until success was won. It is also a subject for congratulation that his efforts were only made successful as a result of the splendid co-operation and support which he received from the Navy Department presided over by its secretary, Mr. Daniels.

"The first advance, then, took place in the substitution of the power of steam through the reciprocating engine for the blowing of wind upon the sails. This great event occurred, as stated, about a century ago, and the steam engine, with improvements, was our only source of mechanical power up to the last quarter of the 19th century, when the steam turbine made its appearance.

STEAM TURBINE ENTERS

"The application of the steam turbine to the driving of ships may be considered as an event only exceeded in importance by the original substitution of steam for sail power in such service. Unfortunately the full benefits of the steam turbine could not be realized because the turbine is inherently a very high-speed machine. While the propeller is best adapted to and is most efficient at relatively slow speed, however, the direct connection of the turbine to the propeller shaft was unquestionably the simplest and most rugged method and was naturally the plan first adapted. Unfortunately it demanded compromises in the design of both turbine and propeller which were only obtained by large sacrifices of efficiency in both.

"Therefore the constant search for improvement led to the introduction of re-

ducing gear between the high speed turbine and the low speed propeller. While the improved efficiency which resulted marked another forward step, it was obtained at the expense of mechanical complications. Furthermore, it must not be forgotten that in both the direct turbine drive and in the turbine geared drive, the power available in reversing the direction of motion was greatly limited. That electricity could be used as a substitute for gears was perhaps obvious, but it was not obvious that it would be practical or economical. In fact, at first sight, it would seem both foolish and wasteful to resort to the double transformation of power involved, in first generating mechanical power from steam, converting this into electricity and then to reconvert the electricity back again into the mechanical power needed to drive the propellers. The correct and natural method seemed as stated, to be that originally followed in practice of applying the power produced by the turbine directly to the propeller, and afterwards to introduce the mechanical gears.

A SEEMING PARADOX

"That the electrical gear could by any possibility prove to be more generally efficient seems a paradox. What is the cause of the undoubted success of this paradoxical device? It is due, we believe, to the fact that in the electric drive an open air space is substituted for the teeth of the mechanical gear. Although we remove the teeth, we are able to transmit tremendous power without any mechanical connection. There is, in fact, no mechanical connection between the fixed and moving parts of the electric motors which may be regarded as the new electric gear, one which by its very nature, prevents the transmission of destructive shock or strain. The electrical method substitutes an indestructible, infinitely elastic air space for the teeth of the mechanical gear and obviously the air space cannot be bent, or broken, requires no lubrication and contains nothing to rub, or get out of order, the electric drive also permits of complete and instantaneous reversal of the direction of motion and thus enables the ship to move backwards under full power and add enormously to its ability to maneuver definitely and quickly."

Admiral Benson Assumes Full Responsibility for Board

Acting under the authority given by the President, Admiral Benson announces that he will assume full responsibility in administering the affairs of the Shipping Board, but that he will not attempt to adopt broad policies which would embarrass the new commissioners to be appointed. By this it is understood he will not attempt to settle such questions as revision of the sales prices, adoption of the bareboat charter plan, enforcement of section 28 or similar questions which can be deferred temporarily. He will exercise his power to decide on current issues, and especially will extend funds which are necessary for the operation of the Government fleet.

MERCHANT MARINE AS AN INTEGRAL PART OF SHIPPING SYSTEM FAVORED BY HOOVER

New Secretary of Commerce Denies that He Proposed to Recommend Acquisition of Shipping Board's Functions by His Department

America's railroad and steamship companies should be operated as a complete system, as an instrument of commercial operation and development in the opinion of Secretary Herbert Hoover, who recently announced his aims upon assuming direction of the Department of Commerce. Secretary Hoover pledged government aid to business and the development of foreign and domestic markets. It was the expressed opinion of the official that the Shipping Board should be separated from executive functioning and the steamship lines operated as an integral part of the transportation system. Secretary Hoover denied that he proposed to recommend the acquisition of the Shipping Board's functions by the Department of Commerce or the acquisition of the railway facilities by that department.

"If we would improve our national efficiency and our foreign trade," the secretary said, "we must consider our transportation, both railway, water and marine, as one system directed to serve the nation as a whole, the development of certain trade routes through the mercantile marine as the real extension of our inland transportation, the improvement of great waterways, opening of the Great Lakes to ocean going vessels, the development of great electrification to our power necessities and the handling of

our labor readjustment by moderate men on both sides and of problems that have a fundamental bearing on our recovering in commerce and on our ability to compete."

Outlining his plans further, Mr. Hoover said:

"Outside of voluntary measures, the only immediate extension of service lies in securing greater internal efficiency, in which I am certain all the bureaus join. The future of the department in its ability to meet the needs of our industries and trade must await the thorough reorganization of the whole executive machinery, now being vigorously undertaken by Congress. The need of it, both in economy and to secure more definite purpose in Government department, does not need demonstration.

"The Department of Commerce," declared the Secretary, "should be in the widest sense a department of service to the commerce and industry of the country. It is not a department for the regulation of trade and industry. In order to do service to great advantage, I wish to establish a wider and better organized co-operation with the trades and commercial associations, and will in a short time present some plans to this end. I want to see our efforts to push our foreign commerce more closely related to our industries."

BOY SCOUT LAUNCHING

Swiftscout Takes Dip at Hands of Boys' Organization

The tanker *Swiftscout*, the fourth of seven 12,000 ton ships of this type to be built by the Northwest Bridge & Iron Company, Portland, Ore., for the Swiftsure Oil Transport Company, was turned over to boy scouts for launching on March 12, the ceremony being one of the most memorable in the history of Portland shipbuilding. The *Swiftscout* was originally intended to be named the "Swiftwind" but the name was changed in honor of the boy scouts' organization.

In thus renaming the vessel and turning her over to boy scouts the oil transport company and Cox & Stevens, naval architects, of 15 William Street, New York City, who are in charge of construction for this company, paid high tribute to the Boy Scouts of America for their service during the war and in times of peace. F. R. Mayer, president of the Swiftsure Oil Transport Company, in a telegram to Charles Desmond, local representative of Cox & Stevens, approved of the plan "as a hearty well wisher of the boy scouts' organization and a personal friend of Baden-Powell." Telegrams of commendation and congratulation were also received by Cox & Stevens from George L. Baker, mayor of Portland, and C. C. Colt, president of the Portland Council, Boy Scouts of America.

The three vessels remaining to be launched are expected to be completed early in June.

FEBRUARY TONNAGE

Bureau of Navigation Reports 111,-609 Gross Tons

The Bureau of Navigation, Department of Commerce, reports ninety sailing, steam, gas and unriggered vessels of 111,609 gross tons built in the United States and officially numbered during the month of February, 1921. This total includes two rigged vessels of 140 tons and seven unriggered vessels of 914 gross tons, a total of nine vessels to 1,054 gross tons built in yearse previous to 1921. Five vessels of 42,311 gross tons were built for the United States Shipping Board.

Five vessels which are not included in this statement were built in this country for foreign owners during the month of February, 1921, and a total of twenty vessels of 3,408 gross tons were reported transferred to foreign flags during the same month.

From other sources than construction, two vessels of 346 gross tons were admitted to American Registry under the act of August 18, 1914.

Tyne Statistics

The number of ships launched from the Tyne in January, 1921, was eleven vessels of 28,054 net registered tons as against three vessels of 5,727 tons in January, 1920.

GROWTH OF ELECTRIC SHIP PROPULSION

The popularity and growth of the application of electricity for the propulsion of vessels, both naval vessels and merchant ships, is shown in the following table giving figures up to January 1, 1921:

SHIP		NAVAL VESSELS			Tonnage Displacement
	Type	Horsepower	Speed, Knots		
In Service:					
Jupiter	Collier	7,000	15		20,000
New Mexico	Battleship	30,000	21		32,000
Tennessee	Battleship	30,000	21		33,000
Being Built:					
California	Battleship	30,000	21		33,000
Colorado	Battleship	30,000	21		33,000
Maryland	Battleship	30,000	21		33,000
Washington	Battleship	30,000	21		33,000
West Virginia	Battleship	30,000	21		33,000
Dakota	Battleship	60,000	23		43,000
Indiana	Battleship	60,000	23		43,000
Montana	Battleship	60,000	23		43,000
North Carolina	Battleship	60,000	23		43,000
Iowa	Battleship	60,000	23		43,000
Massachusetts	Battleship	60,000	23		43,000
Lexington	Battle Cruiser	180,000	33.6		43,500
Constellation	Battle Cruiser	180,000	33.6		43,500
Saratoga	Battle Cruiser	180,000	33.6		43,500
Ranger	Battle Cruiser	180,000	33.6		43,500
Constitution	Battle Cruiser	180,000	33.6		43,500
United States	Battle Cruiser	180,000	33.6		43,500
		MERCHANT SHIPS			
In Service:					
Eclipse	Cargo Carrier	3,000	11		5,000
Cuba	Passenger and Cargo	3,000	17		2,126
Being Built:					
Eleven carriers	Each	30,000	11		5,000
Four coast guard cutters	Each	2,600	16		1,600

SHIP TRANSFERRED

"Wenatchee" Goes to Admiral Line for Japanese Service

The combination passenger and cargo ship *Wenatchee*, after a successful trial trip, has been transferred from the New York Shipbuilding Corporation to the United States Shipping Board, thence to the Pacific Steamship Company for Admiral Line service between Seattle, Wash., and Yokohama, Japan. The *Wenatchee* is a sister ship of the *Keystone State*, *Bay State*, and two other vessels not yet named, built and owned by the Government and allocated to the Admiral Line. The five vessels are known as "535's" (their length in feet), the beam measurement is 72 feet and their cargo capacity is 11,000 tons deadweight. The *Wenatchee* is propelled by two Westinghouse divided-flow turbines of 6,000 horsepower each and is equipped with Westinghouse condenser and steam auxiliaries.

The Admiral Line has announced its determination to establish and maintain a new American service in the face of all competition and is campaigning vigorously to obtain future American business, both passenger and freight, for these ships. The *Wenatchee* is in command of Captain J. E. Guptill.

Eagle Oil Tanker

The Standard Shipbuilding Corporation, Shooters Island, New York, has launched the third of four oil tankers contracted for the Eagle Oil Transport Company, Ltd., of London, England, the ship being christened the *Sun Ubaldo*. She is of 8,400 deadweight tons, 427 feet long, with extreme beam of 53 feet 5 inches, a molded depth of 31 feet and will have a speed of 11 knots.

CIVIL SERVICE COMMISSION TO FILL VACANCIES

The United States Civil Service Commission announces an open competitive examination for foundry helper, on April 27, 1921. A vacancy in the Bureau of Standard, Department of Commerce, Washington, D. C., and vacancies in positions requiring similar qualifications, at \$720 to \$1,080 a year, or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

The commission also announces an open competitive examination for physical laboratory helper on April 13, May 25 and July 6, 1921, at all places in the United States at which city delivery mail service has been established. Vacancies in the Bureau of Standards, Department of Commerce, for duty in Washington, D. C., or elsewhere, at entrance salaries ranging from \$600 to \$900 a year, and in positions requiring similar qualifications, at these or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer or promotion.

FOREIGN YARDS CONTINUE TO SHOW ACTIVITIES IN THE CONSTRUCTION OF NEW SHIPS**Reports from China, France, Norway and Other Countries Reflect Favorable Tonnage Increases**

According to the Shanghai Times, the shipbuilding industry during the year 1920 was very busy. The Shanghai Dock and Engineering Company launched and completed two large standard steamers for the British Government and launched six steel cargo vessels each of 300 tons deadweight capacity for local owners, and one steel twin-screw passenger and cargo steamer for the China Merchants Steam Navigation. They now have in hand two passenger and cargo steamers of about 340 feet long and one steel cargo hulk to carry 3,000 tons deadweight, and a twin screw Yangtze gunboat for the Italian Government.

The New Engineering Works had four large launchings last year and are now constructing two sea going cargo steamers for Norwegian owners. Important extensions and additions were made to the works to cope with the increased amount of work and many new machine tools of the most recent type were imported and installed.

The Kiangnan Dock Company launched two large standard steamers for the American Government and work is now proceeding on two others.

Labor in Shanghai has received several advances to meet the increased cost of living, but output has not suffered, and the yards are now in a much better condition for competing with other countries for the building and repair of ships.

Construction in France

The Chargeurs Reunis have now under construction in France, nine vessels all of which are to be fitted with refrigerating machinery. The Cie. Sud-Atlantique has two under construction and the Transports Maritimes a Vapeur also has two, all of which are to be fitted with refrigerating machinery. Before the war French owners had very few ships fitted with refrigerating appliances for freight, but now nearly all new cargo vessels being built are fitted with this arrangement.

Ateliers & Chantiers de la Loire launched on January 13 the steamship *Baloue* for

the Chargeurs Reunis. This vessel is one of four sister ships specially built to run between France and the West Coast of Africa. They are 392 feet long, 7,500 tons deadweight, with one triple-expansion engine developing about 2,800 horsepower. They have one 40-ton, one 20-ton, and eight 6-ton derricks.

Norwegian Building Increase

The Norwegian mercantile marine's net increase during the year 1920, was 123 ships of about 380,000 tons gross, the gross increase being 223 ships of 490,000 tons. These comprised 169 steamers of 430,000 tons and 50 motorships of 56,000 tons. About 60,000 tons were completed at Norwegian shipyards during the year 1920, as against 47,000 tons during the year 1919. There are at present building at Norwegian shipyards 87 boats with a tonnage of about 100,000, as against 117 boats of 107,000 tons in January 1920. The net increase in tonnage during the year was 22 percent. Christiania tonnage rose by 23 percent and Bergen tonnage by 30 percent.

Danes Also Busy

The Danish mercantile fleet's net increase during the year 1920, was 50 ships of 130,000 tons gross. The gross increase was 108 vessels of about 155,000 tons, out of which 62 were steamers of 120,000 tons and 26 motorships of 28,000 tons. About 60,000 tons were completed at Danish shipyards during the year 1920, as against 35,000 tons in the year 1919, and 146,000 tons are now under construction. The gross decrease amounted to 58 boats with a register of about 27,000 tons. The tonnage of the Danish Mercantile Marine increase during the year 1920, by about 16 percent.

Swedish Figures—head

According to Swedish Export, the Mercantile Marine of Sweden comprised a total of 2,817 vessels of 1,925,000 gross tons. Of this number 1,236 were steamships of 936,000 tons gross, 518 were motor vessels of 125,000 gross tons, and 1,063 were sailing vessels of 837,000 gross tons.

BUSINESS NOTES

The Marine Decking & Supply Company, W. L. Peebles, New York manager, announces the removing of its New York office from 3708 Woolworth Building to 44 Water Street. The company handles among other things litosilo decking composition, Madesco bituminous solution and enamel, and Madesco paints and varnishes.

Scott Brothers & Surtees, Inc., Consulting Engineers and Naval Architects, of 80 Broad Street, New York, announce that they have opened an office at 422 Whitney Central Building, New Orleans, La., and

are now in a position to undertake all kinds of work in connection with design, upkeep, survey and superintending of repairs on ships.

Co-operative Coal Agreement

A cooperative agreement has been effected between the Tidewater Coal Exchange, Inc., of New York and the United States Bureau of Mines for the classification of coal shipped for export through the ports of New York, Philadelphia and Baltimore on a basis of accurate sampling and analyses. The agreement provides for the establishment of limits and tolerances of quality for certain pools and for the maintenance of the quality of the pools within the limits specified.

Marine Construction News of the Month

Ship Contracts—New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Barkentines, Victoria, B. C.—The Cholberg Shipyards are busy handling a contract for four barkentines, one of which, the S. F. Tolmie, is nearly ready for sea.

Marine Diesel Engines, Duluth, Minn.—It is reported that Alexander McDougall, president of the McDougall-Duluth Company, will shortly be in the market for a marine Diesel engine of about 1,100 horsepower.

May Buy Vessels, New York—The Baltic Steamship Corporation of America, 24 Whitehall Street, may purchase several desirable boats from the United States Shipping Board, according to current reports.

Lightship, Tenders, Etc., Morris Heights, N. Y.—The Consolidated Shipbuilding Company is building lightship 105 for the Bureau of Light-houses, Washington, D. C., two lighthouse tenders, as well as two-steel vessels.

New Gears for Ship, Brooklyn, N. Y.—A contract for the installation of new Falk gears in the 8,800-ton Shipping Board vessel West Modus has been awarded to the Morse Dry Dock & Repair Company. The price was given as \$19,000.

Steamer Damaged, Vancouver, B. C.—Wreck Commissioner McPherson has concluded his investigation in the wreck of the Canadian Pacific steamer Princess Beatrice, which is now in dry dock. The vessel is damaged to the extent of \$30,000.

Hulls to Be Converted, Seattle, Wash.—It is reported that the forty wooden hulls built by the Emergency Fleet Corporation and now lying idle in Lake Union, near Seattle, may be converted into lightships, a scarcity of which exists on the Pacific Coast.

Vessel to Be Converted, San Diego, Cal.—It is announced that the Spreckles Bros. Company has purchased the hull of the kelp harvester, Point Loma, formerly operated by Swift & Company. The harvester will be converted into a coal barge and will be used for bunkering purposes at this port.

Overhauling Vessels, Seattle, Wash.—The Puget Sound steamer Aloha, which broke a crankshaft in Hood Canal recently, is undergoing repairs at the Todd Dry Docks on Harbor Island. The Aloha is operated by the Navy Yard Route, and another unit of this fleet is also undergoing overhaul at the same plant.

Overhauling Vessels, Hoboken, N. J.—Among the vessels being overhauled by the W. & A. Fletcher Company are the Baton Rouge, the Vistula and the Chinampa, three Standard Oil vessels. The French-American ship Ice King and United American ship Ipswich are also undergoing reconditioning at the Fletcher yard.

Repair Contract Awarded, Brooklyn, N. Y.—Theodore Crane & Sons, Erie Basin, has been awarded a contract for general repairs to the steamer West Galeta, a Shipping Board vessel, being operated by the Oriental Navigation Company. The price was announced as \$5,800, and the work will probably be done at Pier 86, North River.

Construction Program Nearing End.—Of the 2,312 ships contracted for by the Shipping Board Emergency Fleet Corporation only one more keel is to be laid down before the active

building program will come to an end. There are, however, fifty vessels of 407,412 gross tons under construction and yet to be delivered to the Government.

Repairs for Volunteer, New York.—The war emergency gears on the United States Shipping Board ship Volunteer will be replaced in the near future with a General Electric Company 2-plane gear, according to announcement this week. Superheaters to obtain 200 degrees of superheat will be installed and the turbine modified to meet those conditions.

Repairing Steamer, Brooklyn, New York.—The contract for repairing the Ocean Line steamer City of Columbus which struck on Lovell Island recently has been awarded to the Robins Dry Dock and Repair Company, which was the lowest bidder. The vessel was floated last week and received some temporary patches to her bottom plates at Fore River.

Ferryboat Contract Let, Astoria, Ore.—The operation of an automobile ferry between Astoria, Ore., and McGowan, Washington, is now assured. A contract has been let to the Wilson Shipbuilding Company for the construction of a ferryboat to cost approximately \$22,000. The craft is planned to accommodate fifteen automobiles and fifty passengers and will be ready for service May 15.

Tankers Building at San Pedro—According to word received from O. B. Keibel, works manager of the Southwestern Shipbuilding Company, the company's yard is building two 12,000 tankers for the Union Oil Company. It is also announced that the company has secured contracts for three large tankers to be constructed for the Anglo-Saxon Petroleum Company, which will sail under the Dutch flag.

Reboiling Steamers, Yonkers, N. Y.—The passenger steamer Nassau, of the Highlands Navigation Company, 17 State street, New York, recently left the dock of the New York Engineering Company, where a new Ludlum watertube boiler, 2,500 square feet heating surface, was installed. The passenger steamer Seagate is alongside the company's dock to receive a new Ludlum boiler of the same size as for the Nassau.

Electric Drive for Freighter, New York.—The contract for the installation of motors, generators and similar electric equipment in the American freight steamer Fordonia, of the American-Mediterranean Steamship Company, was awarded to the General Electric Company on March 3. The ship is also to have two Ansaldo internal-combustion engines, which will be installed by the Todd Shipyards Corporation.

Fireboats, New York.—A contract was recently awarded by the city of Philadelphia for a new fireboat to John W. Sullivan & Company, of New York. It will be a twin-screw, steel-vessel equipped along the most modern lines, and will probably be the largest fireboat on the Delaware River. The boat will cost \$249,500, and is to be delivered by November 15. Bids for another fireboat for the city will be advertised for within a few days.

To Repair Yacht, San Pedro, Cal.—John D. Spreckles' yacht Venetia is at the yard of the Los Angeles Shipbuilding Company to undergo general repairs. The yacht is probably one of the best known in the country, having served in the war with Germany, and carries on its stack two gold stars, which tell the tale of two German submarines which the yacht sank, one of which was found to be the one responsible for the sinking of the Lusitania.

Remodel Steamers, Philadelphia, Pa.—The Ericsson Line steamers, Penn and Lord Baltimore, which have been tied up near St. George's for months, are to be remodeled and placed in operation on the route between Philadelphia and Baltimore, via the Chesapeake and Delaware Canal. It is said that the vessels will be cut down, remodeled and re-equipped before they are again placed in service. It is expected that oil burning systems will be installed in the vessels.

Ships for Peruvian Interests, San Francisco, Cal.—It is reported that with the completion of hull No. 10, now building at the yard of the Pacific Coast Shipbuilding Company, the yard will close down. Officials of the company are, however, considering a proposition made by wealthy Peruvian interests to move the majority of its equipment to Central America to handle a program for the construction of a number of ships of which the majority are believed to be war craft.

Steamer Repairs, Brooklyn, N. Y.—The contract for bottom repairs to the steamship Kaduna of the Elder-Dempster Line of Liverpool, England, which recently went ashore, has been awarded at Halifax, N. S., to James Shewan & Sons, Inc., Brooklyn, N. Y. The award was made on competitive bidding of Canadian and New York yards, the Shewan Company bid involving about \$150,000. The work will occupy approximately thirty days, and the ship is now at the New York yard.

Steamers to Be Overhauled, Boston, Mass.—Early next month services of the Eastern Steamship Lines, Inc., Boston, Mass., will be resumed, and the steamers are now being overhauled and placed in readiness. The Calvin Austin and North Land will go on the Boston-New York route and the Camden and Belfast take their place on the Bangor division, the Governor Dingley will ply between Boston and St. John, and the Ransom B. Fuller is to be operated in the service to Portland, Me.

Repair Contract, San Francisco, Cal.—Bids for the work of repairing the steamer Alaskan, of the American-Hawaiian Steamship Company, which recently ran ashore at Asuncion Island, and was found to have thirty-eight plates dented on her forward hull, besides a number of frames and floors, were opened at San Francisco, Cal., recently, and it is announced that the Bethlehem Shipbuilding Corporation has been awarded the contract at a bid of \$143,000. The Moore Shipbuilding Company came second with a bid of \$150,000.

Reconditioning Steamer, New York.—Bids for the reconditioning of the Southern Pacific Company's freight and passenger ship Momus, which is to have new boilers and oil-burning equipment to replace the present coal-burning system, will probably be opened on April 7, according to announcement to-day. Superintending Engineer A. S. Hebble, of the Southern Pacific Company, arranged the plans and specifications, and Babcock & Wilcox boilers fitted with Babcock & Wilcox oil burners will be installed.

Moore Yard Activities, Oakland, Cal.—The Moore Shipbuilding Company is building three Shipping Board tankers of 10,000 tons each, and two freighters for the Matson Navigation Company, each of 14,500 tons, which were recently launched. Hull 166, another 10,000-ton tanker for the Vacuum Oil Company, of New York, is on its way to completion. The H. T. Harper, a motorship of 4,750 tons, being built for the Standard Oil Company, is to have Diesel engines made by the Skandia Pacific Oil Engine Company.

To Purchase Steamers, Los Angeles, Cal.—It is reported that Los Angeles shipping interests are seeking to procure by purchase from the Government five of the new type combined passenger and freight steamers to operate in the Pacific, with San Pedro as their home port. At a hearing before the Los Angeles Chamber of Commerce it was suggested that the ships be sold on an agreed price of \$5,000,000. It is said that the representative appearing before the board was backed by the Duke Tobacco Company interests.

Dry Dock Section Floated.—The first installment of the floating sectional dry dock, to consist of eleven pontoons, and which is to cost \$1,500,000, was sent into the Delaware River, recently, by the Sun Shipbuilding Company, Chester, Pa. The pontoon was towed to the wet dock, where it will be moored until other sections of the kind arrive and the steel superstructure is begun that will finally bind the eleven parts together in a single unit. It is expected that the drydock will be completed and in operation by this summer.

Iceboat.—The New Jersey Legislature has approved the plan and has appropriated \$50,000 for the purchase and operation of an iceboat on the upper Delaware River between Philadelphia and Trenton, to eliminate the ice blockades which interfere with the shipbuilding activities. A similar measure has been introduced in the Pennsylvania Legislature, and Mayor Moore, of Philadelphia, has forwarded to Governor Spruill a communication from Mayor Donnelly, of Trenton, favoring the appointment of a joint commission for the purchase of this boat.

Fireboat, Shooters Island, N. Y.—The contract for a new fireboat for the city of New York, for which bids were opened on February 14, was awarded on Tuesday, March 8, to the Standard Shipbuilding Corporation, on a bid of \$222,000. The vessel is to be 132 feet in length, equipped with compound engines, 18 inches by 38 inches by 26 inches, and will have two turbine-driven fire pumps. Work will be started immediately, to be completed in 245 days. The plans and specifications were prepared by J. W. Millard & Bro., naval architects, 17 State Street, New York.

Barge, Etc., Baltimore, Md.—Contract for a 350-ton self-propelled oil barge for the Standard Oil Company of New Jersey, 26 Broadway, New York, has been awarded to the Baltimore Dry Docks & Shipbuilding Company. The boat is to be 130 feet in length, the motive power to consist of two gasoline or kerosene engines developing from 350 to 400 horsepower.

New bids will probably be called for in the near future by the Standard Oil Company for two 48-foot motor-driven craft to be used as dispatch boats in New York harbor. Bids on these two boats were opened last week, but were rejected.

Dry Dock.—The first section of a new 11,000 gross ton dry dock, being built for Theodore Crane & Sons' yard, was launched yesterday at Erie Basin, Brooklyn, N. Y. When all four sections of the dock have been joined together it will be able to accommodate vessels 500 feet long. The dock will be one of the most modern in existence and the third largest in the port of New York. It is electrically driven and operated by one-man control on the pier at the head of the dock. The dock, which is being built by the Crane Company itself, has centrifugal pumps, motor driven, and is expected to be ready for operation by October 1.

Repairing Schooners and Building New Craft, Seattle, Wash.—One of the most active plants on the waterfront, is the marine ways of the Elliott Bay Marine Construction Company, C. O. Morrow, general manager, where many units of the local mosquito fleet are being overhauled and repaired for the coming fishing season. The Fanny Dutart, one of the largest schooners of the fleet, is being practically rebuilt, her house, decks and other items are being replaced. Several other vessels, including the Cherry, Elizabeth and Imperial, are also undergoing repairs at the plant. The construction of several small craft is also being undertaken.

Diesel Electric Drive, New York.—The 8,800-ton Shipping Board ship West Zaca is to be fitted with Diesel electric drive according to official information obtained by MARINE ENGINEERING. While no specific time for the completion of specifications and the opening of bids has been set, it is believed the work will be undertaken in the near future and will involve approximately \$100,000. Plans and specifications will be completed shortly for making the 12,000-ton Shipping Board steamers Independence and Victorious into electric-drive vessels, bids for which are to be opened in a few weeks. These two contracts will probably involve about \$150,000.

Los Angeles Shipyard Busy, San Pedro, Cal.—The West Lewark, an 11,600-ton cargo carrier being built for the Emergency Fleet Corporation, has been launched by the Los Angeles Shipbuilding & Dry Dock Company. Four freighters of the West Lewark class are now in various stages of construction at this yard. Their overall length is 444 feet, beam molded 54 feet, draft with design loaded 28 feet 2 inches.

The same yard has for reconditioning the Union Oil Company's 12,000-ton tanker Los Angeles and the steamships Yale and Harvard, the latter two having done transport service between England and France during the war.

To Rebuild Motorship.—Bids for the rebuilding of the motorship Trolltind, of the Anglo-Norwegian Shipping Corporation, which was recently extensively damaged by fire at Newport News, Va., were opened on Monday last, at the office of Walter Thompson, marine surveyor, 1 Broadway, New York, with the following results: New York Harbor Dry Dock Corporation, Fort Jefferson, N. Y., \$108,200 (58 days); Tietjen & Lang Dry Dock & Repair Co., Hoboken, N. J., \$108,807 (66 days); Theo. Crane & Sons Co., Brooklyn, N. Y., \$101,357 (75 days); Robins Dry Dock & Repair Co., Brooklyn, N. Y., \$114,600 (70 days); Baltimore Dry Docks & Shipbuilding Co., Baltimore, Md., \$171,900 (120 days). No announcement was made of the awarding of the contract.

Ferryboats, New York.—Plans and specifications will soon be under way for three 225-foot ferryboats for service to Staten Island, construction of which was assured by the decision on March 21 of the Board of Estimate Committee on Financing Budget to make a favorable report to the board, on Plant & Structures Commissioner Grover A. Whalen's application for \$1,560,000 in corporate stock with which to establish a new service to Stapleton. Following the announcement by MARINE ENGINEERING on February 12 of the proposed three boats, it was learned that bids for their construction will probably be advertised for in July, contract award to be made about August 1, with probable delivery of the boats next March. Tentative plans at present call for the synchronous type of motors, watertube boilers producing 250 pounds working pressure, Curtiss turbines, superheaters, and boilers fitted for coal or oil consumption. Of the funds approved, \$200,000 will be used for construction of slips and racks at Stapleton, plans for which are now under way.

PORT IMPROVEMENTS

Docks, Jacksonville, Fla.—The city has voted \$1,000,000 bonds for the extension of municipal docks. John S. Bond is chairman of the City Commission.

Wharf, Pascagoula, Miss.—The city has voted \$15,000 bonds for wharf construction and equipment. Address the mayor.

Winches, New York.—The city will soon be in the market for about seventy-four drum type winches for its municipal docks.

Cranes, New York.—It is reported that W. R. Grace & Company, 7 Hanover Square, has asked for bids on several small capacity locomotive cranes ranging from 3-ton to 7-ton capacity.

Wharf, Graham Landing, B. C.—The Department of Public Works, Ottawa, Canada, has let a contract for building a public floating wharf to L. H. Rawlins, Nakuska; to cost \$23,852.

Wharves, Royston, B. C.—The Department of Public Works, Ottawa, Canada, has let a contract for building the wharves to W. Greenless, 407 Cordova Street, W., Vancouver, B. C.; \$14,774.

Harbor Works, Venezuela.—The Government plans the construction of port and harbor works at Ocumare de la Costa, as well as an electric railroad across the range between that port and Maracay.

Dredging, Oakland, Cal.—The United States Engineer let a contract for dredging the harbor, First District, to the American Dredging Company, 255 California avenue, San Francisco, Cal., to cost \$101,700.

Dredging, Galveston, Tex.—The United States Engineer let contract for dredging the Houston ship channel to the Atlantic, Gulf & Pacific Company, 21 Park Row, New York, involving an expenditure of \$358,440.

Pier, Etc., Portland, Me.—Fay, Spofford & Thorndyke, engineers, 15 Beacon Street, Boston, Mass., are preparing preliminary plans for constructing a pier, pier sheds and dredging of shipways, involving the expenditure of about \$1,250,000.

Freight-Handling Equipment, New York.—Murray Hurlburt, Commissioner of Docks, Pier A, North River, has rejected bids received February 10 for furnishing and installing freight-handling equipment at the foot of East Fifty-first Street, East River. New bids will be called for.

Bulkhead, Baltimore, Md.—The Department of Public Improvements, William F. Broening, president, Board of Awards, Baltimore, Md., let contract to Dorsey & Miller, Equitable building, Baltimore, at \$10,991.48, to construct bulkhead in front of Center Pier, Back Basin. Bancroft Hill is harbor engineer, and H. C. Perring is chief engineer.

Ship Terminal, New Jersey.—The State Board of Commerce and Navigation, Trenton, N. J., has approved the lease of 1,622 lineal feet of bulkheads along the Hudson River to the Luckenbach Terminal Company of Bulls Ferry, at an annual rental of \$87,500. A great ship terminal will be constructed on the property by this company, which operates steamers in all parts of the world.

Pier, Arica, Chile.—It is reported that the Chilean government has appropriated the sum of \$340,000 for the beginning of construction work upon the new pier at Arica. Construction will be similar to that of the several piers now existing with piling of steel tubes connected with steel rod braces and a flooring of timber. A number of steel cranes of from 20 to 50 tons capacity will be required.

Docks, Windsor, Ont.—According to recent reports, the Detroit & Windsor Ferry Company, 2 Woodward Avenue, Detroit, Mich., will build two docks at the foot of Ouelette and Ferry Streets, at a cost of about \$500,000, and in addition will put on a new ferryboat with accommodation for sixty automobiles on the main deck and 2,500 passengers on the upper deck. The dimensions of the new ferryboat are given as follows: Length, 175 feet, with an additional 10 feet in width over the company's other boat, the Britannia.

Dredging Contracts, New York.—The Bridgeport Dredge & Dock Company, Bridgeport, Conn., is announced as the successful bidder for three government contracts in the Hudson river, for which bids were received in New York on March 1. The work consists of re-dredging the harbor channels at Tarrytown, Peekskill and Wappinger Creek, N. Y.

The company has also obtained a contract from the Ingersoll Engineering & Construction Company for dredging in Johnston's Creek,

Bridgeport, to provide sufficient channel depth for the operation of ferryboats in connection with the amusement park at Steeplechase Island. Total approximately \$50,000.

GOVERNMENT WORK

Canal.—The United States Government, Washington, D. C., plans to build a commercial canal from the Ohio river to Lake Erie, to cost about \$25,000.

Quay Wall, Pearl Harbor, H. T.—Specification 4,360, the Bureau of Yards and Docks, Navy Department, Washington, D. C., is receiving bids for building a quay wall.

Pier, Hampton Roads, Va.—Specification 4399, the Bureau of Yards and Docks, Washington, D. C., plans to construct a speed boat pier at the Naval Operating Base.

Riprapping, Mare Island, Cal.—Specification 4390, the Bureau of Yards and Docks, Navy Department, Washington, D. C., plans to riprap Dike 12. This is a large contract.

Electric Light and Power System, Quantico, Va.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans to install an electric light and power system.

Crane and Crane Runway, Brooklyn, N. Y.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will install a new crane and crane runway at the Brooklyn Navy Yard.

Hoisting Plant, Panama, C. Z.—A. L. Flint, purchasing officer, Panama Canal, Washington, D. C., will receive bids until April 4, for the purchase of a hoisting plant for the Panama Canal.

Reciprocating Air Compressor.—Specification 4,327, the Bureau of Yards and Docks, Navy Department, Washington, D. C., is receiving bids for installing a reciprocating air compressor at Bellevue.

Steel Buildings, Pearl Harbor, T. H.—Specification 4404, the Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until May 11 for constructing steel buildings.

Electric Traveling Crane, Puget Sound, Wash.—Specification 4392, the Bureau of Yards and Docks, Navy Department, Washington, D. C., plans to construct an electric traveling crane at the timber storehouse.

Dredging, Providence, R. I.—The United States Engineer Office will receive bids until April 1 for maintenance dredging in the Connecticut River below Hartford. Further information will be furnished on application.

Electric Hoisting Equipment, Lakehurst, N. J.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans to install electric hoisting equipment, as well as an electrically operated platform at the new aircraft plant.

Electric Distributing System, Pearl Harbor, H. T.—Specification 4401, the Bureau of Yards and Docks, Navy Department, Washington, will receive bids until May 11 for constructing an electric distribution system at the Naval Station.

Derrick Boats, Louisville, Ky.—The United States Engineer Office, Box 72, will receive bids until April 7, for furnishing and delivering three steel derrick boats for Lock and Dam 45, Ohio River. Further information will be given on application.

Dredging, Norfolk, Va.—The United States Engineer Office, War Department, Washington, D. C., has let a contract for dredging the 40-foot channel harbor to Sanford & Brooks Com-

pany, Commercial and Water Streets, Baltimore, Md., at a price of \$130,500.

Hopper Dump Scows, New York City.—The United States Engineer Office, Room 710, Army Building, 39 Whitehall Street, will receive bids until 12 M., April 11, for constructing and delivering three 1,000 cubic yards wooden hopper dump scows. Further information given on application.

Coal Bids Rejected.—The Shipping Board has for the third time rejected bids for approximately 2,000,000 tons of bunker coal for twelve months' requirements on the Atlantic and Gulf coasts. The most recent offers ranged from \$5.96 to \$10.50 a ton, depending on the condition of delivery.

Wire Rope, Etc.—The United States Shipping Board, Washington, D. C., will receive bids until April 22 for furnishing wire ropes and hawsers for its ships for three months from May 10. These supplies are to be delivered at Boston, New York, Philadelphia, Baltimore, Norfolk, Charleston, Savannah, Jacksonville, Mobile, New Orleans and Galveston.

Equipment for Coal-Handling Plant, Mobile, Ala.—The water-front site donated by citizens for the construction of a new coal-handling plant for Mississippi-Warrior river service, has been taken over by the War Department, and will be built under the direction of that department. It will include a tippie with loading and unloading machinery, conveying equipment, etc., and is estimated to cost about \$400,000.

Oil Bunkering Station, Blakely Island, Ala.—According to an announcement by the Shipping Board, a fuel oil bunkering station will be erected on Blakely Island about a mile and a half north of Mobile. Bids for the construction of this station will be received until March 30 at the office of the district purchasing agent at New Orleans, La. The Board will furnish fabricated material for the tanks, separate bids for which have already been requested.

Naval Vessels to Be Overhauled, Puget Sound, Wash.—The U. S. S. Frederick, flagship of the Pacific fleet's convoy ships, will be thoroughly overhauled at the Puget Sound Navy Yard, where she will be laid up for thirty days, having arrived in port after an absence of four years. The Idaho, the Mississippi, New Mexico and possibly the Tennessee, the latter warship now being on the Atlantic Coast, will all undergo repairs at the Puget Sound yard, and will be in port all spring.

Navy Yard Improvements, Charleston, S. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is receiving bids for an extension to be made to berth 314, at the Navy Yard. An appropriation of \$190,000 is available for the proposed work. The extension is to be 405 feet long and 59 feet wide, bringing the total length of the pier to approximately 800 feet. This berth is situated on the north side of the drydock and is used principally for repair work. The work of renovating and improving the power plant at a cost of \$88,000 is to begin at an early date.

Bids for Ship Paint.—The United States Shipping Board, Purchasing Department, Division of Supply and Sales, Washington, D. C., will receive bids until 2 P. M., April 15, for furnishing such quantities of ship bottom paints as may be required for the period of six months, beginning May 15, for the following ports: New York; Portland, Me.; Boston, Mass.; Providence, R. I.; Portsmouth, N. H.; Baltimore, Md.; Norfolk, Va.; Newport News, Va.; Charleston, S. C.; Savannah, Ga.; Jacksonville, Tampa, Pensacola, Fla.; Mobile, Ala.; New Orleans, La.; Galveston, Tex.; San Pedro, Cal.; San Francisco, Mare Island, Oakland, Alameda, Cal.; Portland, Ore.; Seattle, Wash., and Philadelphia, Pa., except William Cramp & Sons Ship & Engine Building Company. The estimated expenditure involved, including the application of paint at the port of New York only, will be about \$1,400,000.

FOREIGN ACTIVITIES

Another Contract Lost to England.—A Portsmouth ship repairing concern has lost the contract for repair of the White Star steamer Arabic, which amounted to £100,000, or \$400,000, to a firm in Cherbourg, France.

New Shipyard Planned, Italy.—A group of Italian banks have provided 66,000,000 lire for construction of a great trade and industrial port at Vade, in the Province of Liguria. The plans have been drawn up by Ricardo Negri, engineer. In connection, at the mouth of the Quilliane River, a shipyard will be established.

Capital Ships, England.—According to Sir James Craig, parliamentary and Financial Secretary to the Admiralty, in his announcement in the House of Commons recently, four capital warships of the Hood class will be laid down within a year. The Hood is a battle cruiser of 41,200 tons normal displacement and 44,000 tons with a full load.

Largest Ship for the I. M. M., England.—The former German liner Bismarck, the largest ship in the world, recently purchased by the White Star Line from the British Government, will be renamed the Majestic. She is of 56,000 tons, and is now being made ready for her new owners by German workmen in the Hamburg yards. When completed the vessel will accommodate 3,500 passengers.

Liner for Dutch, Belfast, Ire.—The new 32,000 gross ton passenger liner building at the Harland & Wolff yard, Belfast, for the Holland-America Line, will be equipped with Diesel engines, which are expected to develop 17 or 18 knots. The ship will be named the Statendam, and will be ready within two years. She will be about 800 feet long and have accommodations for about 3,000 passengers.

Port Developments on Danube.—The Minister of Commerce, Dr. Hotopetz, made large contracts, while in London, for building four Danube ports. Bratislava, the largest with three general docks, will be capable of receiving 5,000,000 tons and be fitted with an elevator costing 40,000,000 kronen. The second port of Komorn will be capable of taking 1,000,000 tons. Other ports are to be erected at Parkangnana and Theben.

LAUNCHINGS

Conte Rosso.—Messrs. William Beardmore & Company, Ltd., have launched at the Naval Construction Works, Dalmuir, the Conte Rosso, the first of two ships under construction to the order of Lloyd Sabaudo, Genoa, Italy, for their passenger and cargo service between Italy and South America. The vessel is 591 feet over all length, and of 18,000 gross tonnage. The propelling machinery, which is supplied by the builders, consists of two sets of Parsons combined turbines, each set comprising one high-pressure and one low-pressure turbine and having an astern turbine incorporated in each low-pressure casing. Steam is supplied by six double-ended and two single-ended boilers fitted primarily to burn-oil fuel, but which can be readily converted for the burning of coal.

El Ghazi.—The London & Montrose Shipbuilding & Repairing Company, Ltd., has launched the steel motor-coasting vessel El Ghazi, which they have built to the order of A. Besse, Esq., of Aden, per Messrs. J. Stoner & Company, of London.

The dimensions of the vessel are 132 feet by 25 feet by 12 feet 6 inches molded, and the propelling machinery is designed to give a speed of nine knots, consisting of a set of single screw "Beardmore" oil engines of 200 brake horsepower and in addition to the main engine an auxiliary set of machinery is fitted consisting of air compressor, general service pump and dynamo. The dynamo generates current for the electric lighting installation and for driving two powerful cargo winches and a windlass. The machinery is supplied by Messrs. William Beardmore & Company, Limited, Coatbridge.

NEW INCORPORATIONS

A. B. & C. Shipping Company, Inc., Dover, Del., has been incorporated with a capital of \$1,000,000 to build, own and operate boats.

Marine Oil Company Dover, Del., has been incorporated with a capital of \$1,000,000, for transportation of oil coal, lumber, etc.

Exchange Steamship Company, Wilmington, Del., has been incorporated with a capital of \$100,000 to build, own and operate boats.

Union Maritime Company; Boston, Mass., has been incorporated with a capital of \$250,000; watercraft of all kinds.

Central Steamship & Commerce Company, Wilmington Del., has been incorporated with a capital of \$1,000,000 to build, own and operate boats.

The Barge & Packet Navigation Company, Manhattan, has been incorporated with a capital of \$500,000, by J. H. Clark, Jr., D. A. 'Esperance, Jr., C. E. Buckner.

The Florida Terminal Company, Ocala, Fla., has been incorporated with a capital of \$1,000,000, by Clarence and Jack Camp, Ocala, and G. F. Armstrong, Savannah, Ga.

Halschaw Steamship Lines, Equitable Building, Baltimore, Md., has been incorporated with a capital of \$300,000, by James L. Watson, Ferdinand H. Butchorn, Thomas E. Halle.

Industrial Development Company, Houston, Texas ship channel industries, has been incorporated with a capital of \$50,000, by Paul Wiprecht, E. O. Kruger, and J. Campbell.

Jacksonville Coal & Dock Co., water and maritime rights, \$350,000; T. L. Croteau, M. A. Bruce, S. E. Dill, Wilmington.

Metropolitan Securities Corporation, New York, has been incorporated with a capital of \$50,000, by Lawrence N. Martin Patrick J. Dolson, and William Shea to build and operate boats.

National Mercantile Marine, 3 East Lexington Street, Baltimore, Md., has been incorporated with a capital of \$100,000, by Frederick W. Flottwell, Frank E. Welsh, Jr., and Harold Lee, to carry on a transportation business.

The North & South Line, Inc., Wilmington, Del., has been incorporated with a capital of \$10,000 to establish and maintain line of service of steamships; T. L. Croteau, M. A. Bruce, and S. E. Dill, incorporators.

Overseas Salvors, Inc., has been incorporated with a capital of \$600,000 to engage in ocean commerce; John W. Crandall, E. M. Potter, and I. W. Bonner, New York, incorporators.

The Fred E. Jones Dredging Company, Norfolk, Va., has been incorporated with a capital of \$250,000.

B. H. Elliott, Inc., Houston, Tex., has been organized with a capital of \$20,000, by Don Hall B. H. Elliott and W. P. Buckley to operate a shipbuilding and repair plant.

United States Salvage Association, Manhattan, marine surveying, etc., 2,000 shares common stock, no par value; active capital, \$10,000; L. F. Burke, W. W. Parsons, E. C. Jameson, 9 East 69th St.

Hunts Point Iron Works, Bronx, \$10,000; Kopelson, G. and E. Lippert, 2555 3d Ave., Bronx.

Navigation Paint Co., Manhattan, marine painting, \$5,000; M. E. Graef, E. Light, M. Erenstoff, 65 Lenox Ave.

Deep Water Salvage & Drydock Co., Seattle, Wash.; capital \$1,000,000.

TRADE PUBLICATIONS

Multiscreen Filter.—The construction of a multiscreen filter, designed to remove oil, grease and other foreign matter from condensed steam is described in a pamphlet published by the Griscom-Russell Company, 90 West Street, New York. Tables of capacities and examples of typical installations in steam lines are included.

Equipment Bulletins.—Interesting literature, combined in complete sets of bulletins on automatic-steam engines, steam-pumping machinery, high efficiency power pumps, steam turbines and centrifugal pumps, water-wheel equipment, oil-mill machinery, oil-burning equipment, etc., is being offered by Charles F. Ames & Company,

Ltd., hydraulic and contract engineers, 90 West Street, New York City.

Life Saving Equipment.—Two folders, giving the details of Welin quadrant davits and Lundin deck lifeboats, have been issued by the American Balsa Company, 50 East 42nd Street, New York. Other types of life-saving equipments also briefly described, including semi-decked lifeboats, collapsible lifeboats, life rafts, sheath-screw davits, Balsa wood insulation for refrigerators and accessories for all this equipment.

Safety Starting Switch.—A small folder published by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., describes and illustrates a safety-starting switch for alternating-current motors of squirrel-cage type. The folder states that this switch protects the motor by inserting the fuses in circuit only after the motor has reached speed. When the switch is off and the fuses are dead a heavy panel on the enclosing case may be lowered to allow inspection and the renewal of fuses.

"Steering You Straight."—Construction and operation of the Benson electric telemotor are outlined in a catalogue recently issued by the Benson Electric Company, Superior, Wis. This telemotor is designed to perform the function of steering on the "follow up" principle and consists essentially of three units, a master controller, a set of relays and the telemotor proper. When the handle of the master or the auxiliary controller is moved out of the midship position electromagnetic relays are excited. The movement of the relays closes an electrical circuit with the telemotor which is connected to the steam-steering engine valve and causes the proper movement of the rudder. A series of letters giving examples of operating records with the Benson telemotor are also published in this book.

Needless Rdn.—A fire protection system specially efficient on oil-burning vessels and tankers where the hazard is great is described in a pamphlet issued by the Foamite Firefoam Company, 200 Fifth Avenue, New York. This system for extinguishing fires consists of smothering a blaze by means of a blanket of carbon dioxide bubbles which may be sprayed from a sprinkler system, extinguishing engines or hand sprinklers. Instances of the use of various types of apparatus utilizing this means of protection aboardship are given. In connection with these, the details of the Fire Detecting Wire System for locating incipient fires are described. It is claimed that the two systems working together for detecting and extinguishing fires form one of the most efficient methods of ship protection against fire.

Habirshaw Manual.—The Habirshaw Electric Cable Company of Yonkers, N. Y., through its engineering field service, is making investigation of the requirements and practice of the wiring of ships. This investigation is based upon the application of the requirements of the marine code, which was formulated in 1920, by the Marine Committee of the American Institute of Electrical Engineers. This work is enabling the company to prepare a manual on marine wires, based on the above mentioned code, which would be similar in arrangement to the Habirshaw manual issued some time ago. This manual on marine wires will appear serially in the advertising pages of MARINE ENGINEERING. By clipping these advertisements and preserving them in some suitable form, readers will eventually have a complete manual on marine wires and cables.

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INSTITUTE OF MARINE ENGINEERS, INCORPORATED

The Minories, Tower Hill, London.

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